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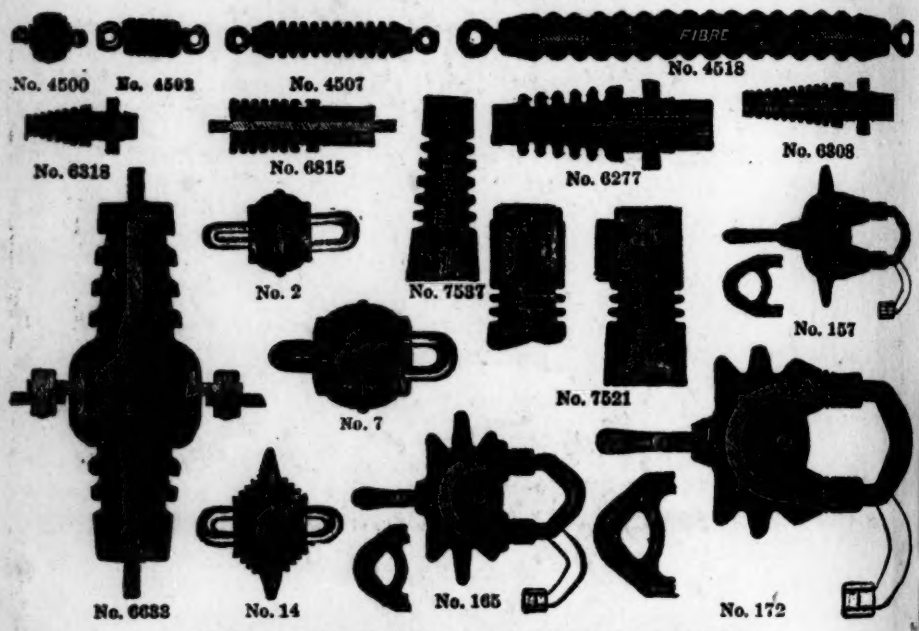

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FORMS OF GOVERNMENT IN RELATION TO THEIR EFFICIENCY FOR WAR

By Rear Admiral A. P. Niblack, U. S. Navy

General Considerations

In our diplomatic relations with countries it is essential that we study forms of government. Other governments, recognizing the complexity of our own system, send to Washington selected persons as ministers or ambassadors and, with the view of solving other difficulties, often select those with American wives. Had the governments associated with us in the late war fully understood that our President practically shares the treaty-making power with the Senate, they would probably have pursued a different course in framing a treaty in Paris. If misunderstandings, therefore, arise among statesmen from such elementary causes, it is important that we examine the forms of government of at least the principal powers, such as Great Britain, France, Japan, and Germany, with which our future relations are so important.

It would be bold to say that the war just fought out was fundamentally between England and Prussia not only as dominating their associates in their respective governments, but as political and commercial rivals in Europe and in the world, but in April, 1848, in the House of Commons, Disraeli stated that the commercial and political importance of the rising state of Prussia on the North Sea should not pass "unnoted and uncensured" by

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England, and so we may assume that this merely voiced an uneasiness rather than foresight. It might seem, therefore, that the first demand of the Allies in the peace settlement would naturally be the assurance that Prussia should be divided up into smaller states as being too large and too dominant a factor in Germany. It is here shown, on the contrary, that the new German Constitution has effected this without the intervention of the Allies, and it would seem that the German people themselves recognize the undesirability of the former political arrangement. A study of the new German Constitution will further show that it embodies all of the advantages of our own, while avoiding many of the clumsy features of both our own and the German Constitution of 1871, which, in both cases, were due to compromises which had to be made to effect confederation or federalization of sovereign states into a union of states.

Probably the most interesting study is the Japanese Constitution, which is now threatened with changes growing out of the march and trend of world conditions. The business and industrial classes are growing in power and influence, and a struggle with the military party now in control is inevitable. In all sympathy, one can but recognize that the problem in Japan is to first make it safe for democracy, since the question is one of the gradual surrender of autocratic power into the hands of the people only when they are fit to be entrusted with it, and is not one of abstract right, since national safety is the highest obligation. After all, constitutional government is only of recent development and only in the experimental stage. There is no more sacredness in constitutional government than there is such a thing as the divine right of kings. In Japan the Emperor is still sacred, and China disappointed and offended the sentiment of the Japanese people when it became a republic. The monarchic form of government suits some countries better than would a republic. However little real political power the King of England may actually exercise in England itself, he is nevertheless the Emperor of the British Empire. If the crown did not exist it would be quite logical to create it, and the stability of the throne in England comes from pressure from without as well as from support within.

One of the best features of our own Constitution is the sacredness with which it is regarded, due to the high respect we have had for the framers of this wonderful instrument, but the elec-

toral college, the length of the presidential term, the status of the cabinet officers, the undue powers of the Senate, and legislation by committees of Congress are matters which admit improvement in the direction of fixing responsibility and improving the efficiency of our government. We have local self-government carried to its legitimate conclusion. Each township, city, county, and state gets very much the government it deserves, but the powers given to the unequal states through equal representation in the Senate infringes too much the authority of the central government and curbs too much the democratic and representative character of the House of Representatives. Local self-government is too often interpreted to mean an absorption in local affairs to the exclusion of grave international considerations. Local political considerations due to the necessity for re-election is the penalty we must necessarily pay for representative government in the House of Representatives, but, when party politics invade the Senate, it has a baleful effect upon our international relations and tends to reveal our country to the world as rather narrow and provincial.

The Senate is too much of a tradition. Tradition is a splendid thing for it is the teaching of the elders. The code, the culture, or "kultur," under which we live and anything which preserves us true to the traditions of the pioneers who founded this government of the people for the people and by the people is a good thing, but the Senate, through its committee organization, is not responsive enough. As cabinet officers are not responsive to popular demand and not removable by any other process than the will of the President, or by impeachment, some branch of the government must be responsive and certainly the Senate is least so. We, of course, in these United States, really live under the British tradition, just as countries in Central and South America still live under the Spanish tradition. Our weights and measures, our literature, our common law, our social customs of making the first visit, our clothes, our language, our various religions, and many of our sports have come down to us from colonial days, but this study will show the striking dissimilarity of our forms of government. The basis of friendship of the two great English-speaking peoples is rivalry and independence of each other, and these are the really true and lasting bases of all friendships. The instant the condition of dependence arises between two equals the essence

of friendship is lost and another relation takes its place but it is not friendship. There is no necessity for an alliance between Great Britain and the United States, and there probably never will be one, but, in effect, it exists, or must exist, through conditions which are arising in the world and which will hereafter necessitate that the two countries stand together; otherwise, they may fall together.

In the discussion of forms of government which follows, the view is taken that the highest obligation is national safety and national defense. This is not a militaristic view, but a statesmanlike one. It is distasteful only to politicians whose view is that the highest obligation is the success of the party to which they belong. To the politicians we must credit many of the subtle changes in the spirit of constitutional governments which take the form of "jokers" in the government, which we must be on our guard to detect. In considering governments in relation to their efficiency for war it is a curious fact that we find the army and navy, as a rule, not in sympathy with the politicians, and the politicians not in sympathy with the army and navy. It is probably because their codes are different.

THE "JOKER"

In considering the form of government of any country in relation to its efficiency for war, its ability to maintain preparedness for war, and its organization for conducting the operations of war, it is not necessary to go back beyond constitutional government, as all modern governments are at least constitutional in form. Nor need we consider forms of government other than those of the principal powers. The main thing is to be able to detect the "joker" in the real government whereby, under any form of constitutional government, there may lurk a centralized power which silently directs governmental action, for it is very important to realize that a written constitution is merely a proposed plan of "government by law" instead of by an individual or clique, and does not necessarily disclose the actual workings of the government, because, in growing or expanding countries, the government is apt to find itself hampered by constitutional restrictions, like a suit of clothes which it is always outgrowing, and the tendency is always, therefore, towards modifying the

rules of the game to suit new conditions, if not to over-ride the constitution itself. We will see later on that it is important even to study the methods by which modifications or changes in the constitution may be brought about as indicating how deeply the "joker" is intrenched.

CONSTITUTIONAL GOVERNMENT

The history of constitutional government is briefly as follows: The English Revolution was the first to establish the theorem that sovereign power rests in the people and not in the crown and that the function of the head of the state is merely to execute the will of the people. It did not bring about a written constitution and the existing system of government in England may be said to date only from the Reform Bill in 1832. America was the birthplace of written constitutions and the Constitution of the United States is the oldest written one in the world to-day, as it dates back to 1787, while that of Italy dates from 1848; of the former Austro-Hungarian Empire from 1870; the German Empire from 1871 and now 1919; France from 1875; and Japan 1889.

In most written constitutions the powers of the central government, or of the ruler, and of the individual states, are enumerated, and the powers not enumerated are reserved for the other branches of the government. In such cases it is necessary to have some form of high court to determine whether laws enacted by the central government or by the states are in conformity with the constitution, in case of dispute as to the validity of any law. Experience has shown, in the United States, that the central government has not had enough power and that federalization has not worked well for national safety, because of the too strong local self-government. There have also been constant appeals to the Supreme Court of the United States and the higher courts of the states. In other words, modern ideas are somewhat against federalization and a too minute enumeration of the powers of either the central government or the separate states. The South African Union Act of 1907 is an excellent example of written constitutional government, in that it abandons, or rather avoids, the difficulties of federal government by not enumerating the powers of either the separate states or the central government, but places all power in the Union Parliament which is permitted to delegate

power in part to any of the states of the union. The Union Parliament may at any time prescribe the laws for any one of the separate states, if it is not satisfied with those which the state itself is being governed under. It, to a large degree, copies what the British Government has practically become under the working out of the Reform Bill of 1832 and the subsequent acts of Parliament carrying out the electoral reforms, which reforms were really only superficial. They merely lowered the property qualifications, gave democratic local self-government to boroughs, parishes, and counties, but, with it all, Parliament dominates the local governments and may sweep them all away with a single act. *The democracy of England is in its assertive individualism and exists very slightly in its government.* As will be seen later, there are almost no points of resemblance between the forms of government of Great Britain and the United States of America.

UNIONS

Nearly all modern states are combinations or unions of smaller ones, which a common danger or political exigency have united. There are, however, all degrees of union. Speaking only of the so-called Great Powers of the world, we find in Italy and France a complete consolidation of former independent countries without federalization. In view of the wars and rivalries of the separate states and provinces comprised in modern Italy and France, this is surprising. In the United States and in Germany, we find a federalization of separate and sovereign states. In the United States imperfect federalization cost us five years of civil war. In Germany the individual states, under the constitution of 1871, enjoyed too much independence of the central government. In the new constitution, promulgated in August, 1919, the still so-called "German Empire" is declared to be a republican state, with sovereignty residing in the people and, while individual states will enjoy legislative rights, the imperial law will govern. This is a long step towards centralized efficiency, and the newly promulgated German Constitution avoids the weakness of the former empire in this respect.

The United Kingdom of Great Britain and Ireland, on the other hand, is a very imperfect or loose union, in which Scotland and Wales enjoy wide liberties and Ireland is always seeking impossible independence. Japan has no existing traces of fed-

eralization. The tendency of federal government is always to extend the powers of the central government at the expense of the component states, and it is a curious fact that federalization is really not necessary to an efficient government, provided the central government has the right to delegate authority to, or frame the form of government of, the various states or provinces. In the new German Constitution there are rules for altering the Empire territorially, providing that plebiscites shall be held in districts affected. This is a clever blow, or entering wedge, to lessen the power of the individual states, coupled as it is with the provision that Imperial law supersedes those of the individual states through this provision. The demand recently made by the Entente powers that the new German Constitution be modified was intended to prevent German-Austria from entering the German Empire. Evidently they regarded this new provision as to territorial changes as a direct invitation to Austria to enter the German Empire. Under the terms of the new constitution, the former Bundesrath becomes the Imperial Council composed of representatives of the individual states, which will have at least one vote apiece, but no state can have more than two-fifths of the total number of votes in the Council. The Imperial Council has much less authority than the former Bundesrath, and, while far from being a Senate or second legislative body, its share in the control of the budget gives it the necessary vitality or virility.

CHECK AND BALANCE

The theory of the United States Government is based upon that of "check and balance" by means of a division of powers between the Executive, Legislative and Judicial branches. Neither may perform the duties of the other. The Executive cannot initiate legislation, but can veto. The Legislative branch cannot pass a law which is effective if the Judicial branch decides that it is contrary to the Constitution. Whereas, in other countries, constitutions have been brought in force to restrict the powers of the crown, the authority of the President of the United States is prescribed in the Constitution (or in other words his powers are enumerated) and Congress has always been willing to increase these powers by special acts rather than to restrict them. In other countries, except Germany and Japan, the restriction of the powers of the ruler, and the prevention of clashes between the legislative and

executive branches has led to the holding of cabinet ministers responsible for the executive acts of the head of the government. It is the cabinet which gets blamed and goes out of office. This is known as the Cabinet or Parliamentary form of government, as distinguished from the Presidential, and it has the effect of weakening the executive power of the ruler even to the point, in some countries, of rendering him a political "figure head." It is a curious fact that Germany, Japan and the United States are the three countries of the so-called Great Powers which have the Presidential form of government, in that the Cabinet is not answerable to the Parliament. In fact, Japan, the United States and Germany (under the former and present constitution) are similar in most of their forms, but in Germany and Japan it is provided in the constitution that a responsible minister must countersign all executive acts. There is, however, in none of these countries, a collective responsibility of the cabinet ministers to the legislative bodies. On the contrary, the responsibility is to the executive and only individual ministers may be held answerable to the legislative body, usually by impeachment proceedings, or a direct vote of censure.

THE OFFICE OF PRESIDENT

The United States differs from all other Great Powers in that the President is responsible for all of his own executive acts, and his Cabinet is not at all responsible for them. He may be impeached, and he can be, and often is, defeated at the poles for re-election. It is observable that a President is usually bolder in his second term than in his first, because he cannot count on being re-elected for a third term. The thing which baffles and puzzles all foreigners is that the President is, on the one hand, the leader of his political party, and, on the other, he is the impartial ruler. The President goes before the country just as the Prime Minister of a Cabinet does in parliamentary countries, to advocate or defend his policies. He has so much power because Congress and the people give it to him by special legislation in many cases. Besides, as leader of his party, he may and often does use pressure on individual legislators to change their views. Historically, however, when there has been conflict between the President and Congress, and the President has toured the country to carry his policies against Congress, he has invariably failed. Whether or

not it is a desirable thing to give the Chief Executive so much power is apart from the question, for there are very essential restrictions on the powers of the President, such as requiring the nominations of all appointees, even cabinet officers, to be submitted to the Senate for their approval. All treaties have to be approved by the Senate. A declaration of war can only be made by Congress. Legislation can only be initiated by Congress itself, and the President is restricted to proposing legislation by messages to Congress. The "joker" in our government is in the power given to the President and Cabinet through censorship, through patronage, and through official pressure, which, on the one hand, may be used to strengthen the country in its foreign relations and in national safety, but, on the other, may risk the national safety for party expediency. In all fairness it should be said that the Presidential form is practically open to less abuses of this kind than the Parliamentary, and, above all, rightly understood, our government may easily be made the most efficient in the world for military preparedness without the invasion of any one's real liberties or rights, to the perpetuation of our free institutions, and with the participation of individual citizens in obligations as well as in the benefits of the democratic form of government.

THE NEW GERMAN CONSTITUTION

An analysis of this instrument will show that it is a masterpiece in written constitutions and reflects great credit on Dr. Hugo Preuss, its reputed author! It may be well to state briefly some of its fine points.

The members of the Reichstag are elected for four years. The President is chosen by the entire German people and for a term of seven years. As before stated, the President's executive acts must be countersigned by the Chancellor or the Cabinet Minister whose department is affected, but the Chancellor and Cabinet are selected by the President. The President, Chancellor, and Minister are, however, only subject to the will of the Reichstag through impeachment by proceedings which can be instituted only after signature by at least 100 members of that body. If the President so desires, laws may be submitted to the people direct, and, if approved, they have the same force as if enacted by the Reichstag. The constitution can be altered by a quorum of two-thirds

of the Reichstag voting for alteration by a two-thirds majority. The "joker" in the new German Constitution is therefore that it gives to the Reichstag the power peacefully to overthrow the government by a two-thirds majority of a quorum, and thereafter constitutionally to install a King or an Emperor in place of the President. Another "joker" which the Entente has protested is the possible and easy admission of Austria into the German Empire under the plebiscite clause of the constitution.

The "joker" in the former German Constitution was that there were 17 votes for Prussia in the Bundesrath out of a total of 58, which 17 votes could defeat an amendment to the constitution, and all existing arrangements would continue in force and also all laws concerning the army and navy and taxes, if the Prussian delegates so voted. This practically placed the veto power in the hands of the Prussian members of the Bundersrath, and the Emperor personally appointed these members. Contrary to the popular idea, however, the late German Emperor's powers, either in legislation or in military matters, were slight when compared with those of the President of the United States or the Emperor of Japan. He executed the laws, but his personal influence and freedom of speech were extra-constitutional in reality. He could not dictate policies, but he could replace the Chancellor, the Chief of the General Staff, and all the Cabinet Ministers, etc., and, in the end, gain his point very much as the President of the United States may do.

DEFINITIONS

So far, we have pointed out that there are no traces of federalization in some countries, and, in others, a loose union holds countries together; that where check and balance is seemingly absent from any government, the cabinet may be overturned by an adverse vote or by a political crisis, as in Japan; that local self government is not incompatible with strong centralized government; that the cabinet form of government does not go with a bicameral legislature of equal powers; and that it is not idle talk to speak of "jokers" in forms of government; but, in order to definitely analyze the various forms of government, it is necessary to resort to definitions.

IMMEDIATE OR REPRESENTATIVE

I. In the first place, we speak always of Representative government. The opposite of this is Immediate.

In the Immediate form of government, which may be monarchic, aristocratic, or even democratic, the state exercises directly the functions of government. It is, therefore, unlimited in form, and may be as despotic as it wishes, as the state and the government are practically identical. Strange to say this is, in effect, the actual form of the British Government which is Immediate.

Representative government is that form in which the state vests the power of government in one or more organizations more or less distinct from its own organization. It too may be unlimited or limited according as all or only a few of the population of the state are made eligible to hold office or mandate. This is something different from the right to vote, which is also restricted in most countries. In other words, the word "representative" implies the degree of eligibility to hold office rather than merely the right to vote.

UNLIMITED OR LIMITED

II. It will be noted that there is a fundamental distinction, scientifically speaking, between the state and the government of a state. In ordinary conversation no such distinction is usually made. It is sufficiently accurate for our purpose to say that the state is somewhat of an abstraction but represents the sovereign power, and the government is the administrative machinery.

If the state vests its whole power in the government, the form of government may be said to be *unlimited*. If, on the other hand, the state confers upon the government less than its whole power, less than practical sovereignty, either by enumerating the powers of the government, or by defining and safe-guarding individual liberty against this delegated power, the government is *limited*. It does not imply that an unlimited form of government is a despotism, nor that the limited form of government may not actually be twisted into despotism. It is merely a distinction as to the general tendencies, as all governments are now constitutional in form and no despotism should be really possible.

CENTRALIZED OR FEDERAL

III. Next we come to the manner in which the governmental power is either centralized or distributed, or in other words, whether it is the centralized or the federal system of government.

Centralized government is that form in which the state vests all government authority in a single organization, and there are no independent local governments or quasi states in which local governments may be established, modified or displaced at will by the central government. (Great Britain is of this type and it is important to note that a government may be centralized in form but not immediate or unlimited. It equally may be immediate and limited and not centralized.)

Federal government, in counter-distinction to centralized, is the form in which the state distributes the power of government between two classes of organizations as fixed in a constitution limiting the powers of each. This is the confederate and federal form of government, in which sovereign states retain a certain measure of local self-government and independence in local matters, but are under a strong central national government in all essentially national matters. The confederate form is the transient one where sovereign states unite, as in Germany in 1870, leading gradually, as in the United States and in the new German Constitution, to federation and gradual centralization of power in a central government, while retaining a measure of local independence of the units.

CONSOLIDATED OR CO-ORDINATED

IV. There is a further and finer distinction as to the distribution of governmental power in the central government or state itself, viz., consolidated or co-ordinated. In the consolidated form of government the state confides all governmental power to a single body. (In England practically all authority is vested in Parliament, which implies that the House of Lords is a part of Parliament. Everyone knows, however, that the House of Commons really governs Great Britain, and the British Government is therefore consolidated in form.)

In the co-ordinated form of government, the state distributes the powers of government between separate departments or bodies, each equal, independent of, but co-ordinated with, the other or

others. The United States is the best example of this, where there is check and balance between co-ordinate branches of the government.

HEREDITARY OR ELECTIVE

V. As to the tenure of persons holding office or mandate, the distinction is made between hereditary and elective. Hereditary is self-explanatory. Elective means chosen by the suffrage of enfranchised persons, whether or not the franchise is by universal suffrage or by the most restricted kind of suffrage, as in Japan. Elective need not necessarily imply democratic. In the degree in which a country is democratic, the governing group has to get the assent and support of large masses of the people. Where things are done which run counter to the inertia, bias and apparent interests of the masses, the elections which follow are apt to express the will of the people. Where, by political manipulation, the people are deprived of their right to express their will, we have the form but not the substance of democratic government. Where the right to vote is restricted abnormally, as in Japan, it is merely a fiction to call the government really elective.

Where there is mixed elective and hereditary tenure, there results several forms of government which depend upon the degree of consolidation and co-ordination. In the monarchic form, the state is represented by a single person. Where there are also a number of persons holding hereditary mandate or tenure of office, it becomes also an aristocratic government. When the state throws wide open the eligibility of persons to have membership, voice and vote in the governing body, it is democratic. Thus England is monarchic through its King who has no political power; aristocratic through its House of Lords which has a dwindling political power; and is supposedly democratic through having a House of Commons elected through restricted suffrage, but the "joker" in the British Government, as will be shown later, is that it is in effect an oligarchy, and its democracy is more or less a figure of speech, since all the democracy is in the local self-governed boroughs and not in the government. This is merely a personal view, and not necessarily the accepted one.

PRESIDENTIAL OR PARLIAMENTARY

VI. There is finally a very vital distinction between forms of government in the relation of the legislative to the executive power, and, for convenience, the two forms are characterized as either *presidential* or *parliamentary*.

In the *presidential* form the state regards the executive head of the government as an individual quite independent of the legislature or parliament, both in tenure of office and in prerogatives, and furnishes him with sufficient power to prevent the legislative body from encroaching. This is the form of the Japanese, the old and new German, and the United States Governments, in which the Mikado, German Emperor (now German President) and our President execute the laws.

This is a highly practical form of government. It is conservative and fixes the responsibility upon a single person. It is energetic because not subject to divided council. It is powerful, in that a single capable person is not unduly limited by a division of counsel and difference of views, and his decision must be obeyed.

In the *parliamentary* or *cabinet* form, the state confers upon the legislature the complete control of the administration of law. The cabinet of ministers is responsible for the execution of the laws, that is, it represents the sovereign in the exercise of executive power. The cabinet is dependent upon the will of the legislative body, and an adverse vote puts the members out of office. This constitutes the "check and balance." As there are, in most countries, two independent legislative bodies to give validity to any act, the control of the administration or execution of the act naturally gravitates to that house, which, by custom or the constitution, has the greatest power over the revenues of the government. The cabinet form of government in effect destroys practically the independence of one of the two houses of the legislative bodies. It makes legislation easy, but it is inconsistent with a definite policy, although it requires the members of the legislative body to have full information upon all subjects concerning which it must act, through the presence and voice of the heads of the administration in the legislative body. In our Congress this information goes to committees, and we thus have legislation by committees, as members of the House and Senate usually vote on the strength of reports made by their own different committees.

In general, cabinet or parliamentary form of government is weakening to continuity of policy. New ministries which are formed are commonly the result of the coalition of small political groups which are not long held together.

France in the last fifteen years has had ten ministries, and Spain many more. The two-party idea in Great Britain is what saves it from frequent changes, for the opposition party will not overturn the ministry until it is willing and able to take over the administration with a definite policy. In connection with our own government, it is again important to note that cabinet government is inconsistent with the existence of two legislative bodies of equal power, such as our House and Senate. The power of the United States Senate, through the provision of the Constitution whereby each separate state is represented by two Senators, makes it impossible for the House to dominate the Senate and the control of legislation really rests with the Senate more than with the House.

The two-party system in America also makes for stability because, where there are small minorities which can hold the balance of power between the two parties by throwing its weight with one party or the other, yet it can only defeat certain legislation but cannot overturn the government. We may, in fact, regard ourselves as extremely fortunate that we do not have the cabinet form of government, provided we reform certain weaknesses in the presidential form. In the United States the principle of the separation of powers was believed to make it impossible for the executive either formally to initiate legislation by introducing bills into Congress, or to participate either personally or by deputy in congressional debates, and even his veto can be overcome by a two-thirds vote.

Recent tendencies in the United States would, however, seem to show that the American system is changing and is coming to resemble more and more the Imperial System. The executive is growing more and more important and is exercising more and more influence, if not control, over the making of laws and the adoption of policies. This may or may not constitute a "joker," but little important legislation is now adopted by the United States Congress which does not have the support of whoever is President. What is true of the United States national government is also in a measure true of the state governments. State governors

are more and more influencing state legislation and state policy. Finally, our Presidents use their power to send messages to Congress as a means of forming or influencing public opinion. He also takes advantage of the opportunity to speak on important occasions such as large public dinners, the anniversaries of important public events and to tour the country to propose and support new policies. President Roosevelt is reported to have said that the President of the United States occupies the most influential pulpit in the world.

In all these ways, then, a President may exercise an influence, if not a control, over the members of Congress. Where a President's policies are approved by the people, it is not infrequently the case that showers of telegrams and letters descend upon members of Congress from those they represent, and do much to induce them to support the proposals of the President.

In making the choice between presidential and cabinet or parliamentary government the opportunities under the former, for lack of harmony and for conflict to develop between the executive and the legislature, must be offset by the inefficiency and lack of continuity of policy which may be expected to develop under the latter in those countries in which it is impossible to organize two strong political parties, upon one of which the cabinet may with confidence rely for support.

IN GENERAL

There is no great virtue or vice necessarily in any form of constitutional government except in so far as it protects the liberty of the individual, and on the other hand compels the individual to recognize fully his obligation to the state. Internationalism, Bolshevism, Radical Socialism, Pacifism, Unionism, Individualism and all the other ancient and modern *isms* fundamentally weaken the obligation of the individual to the state while demanding extreme liberty, or, in other words, demanding something for nothing. Governments are merely the way human beings group themselves for co-operation, for there must be co-operation and social cohesion in human society. The age of individualism has now definitely passed. Liberty implies obligation. Government implies obligation. Society implies obligation. Liberty is not the apotheosis of selfish individualism. The highest obligation is national safety and national defense. This is true whether we

regard the state as merely a great public service corporation, or as a sacred institution set over and above the people of the country. Executive efficiency, patriotism of individuals, and mutual co-operation of forces controlling the national resources of the commonwealth are the essential requirements of modern forms of government.

In 1532 Machiavelli expounded his theory of the state and the methods of securing its advancement. The doctrine he preached was that men should look for their safety to the state rather than to the church, and that the state should consist in absolute and irresponsible power vested in one man, who should embody its unity, strength and authority. To evolve a formula for testing constitutional governments in relation to their efficiency for war has nothing Machiavellian about it, but is a real patriotic duty.

The formula is as shown in the following form which is merely the summary of our definitions:

Forms of Government

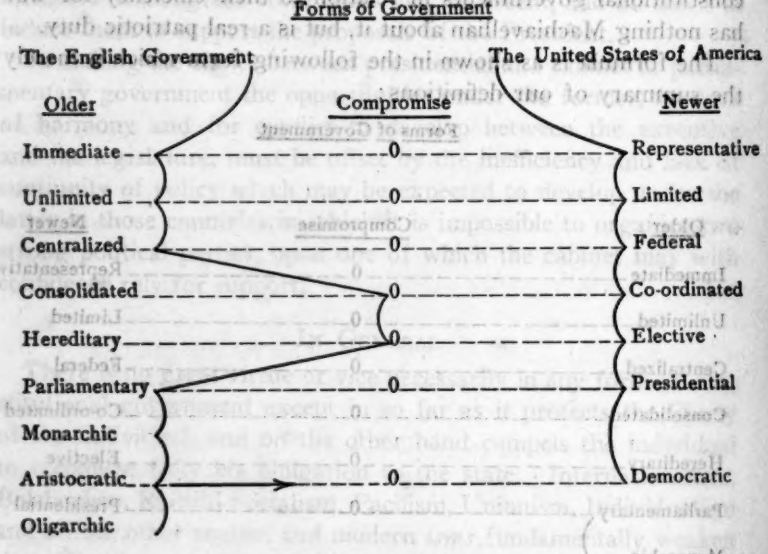
Older	Compromise	Newer
Immediate	0	Representative
Unlimited	0	Limited
Centralized	0	Federal
Consolidated	0	Co-ordinated
Hereditary	0	Elective
Parliamentary	0	Presidential
Monarchic / Aristocratic / Oligarchic	0	Democratic

APPLYING THE TEST

It is now in order to test the forms of government of the most important countries with a view to comparing them as to their efficiency for war. We should not be surprised to find that in some governments there are compromises between two extremes. This we may indicate by the middle line.

THE GOVERNMENT OF THE UNITED STATES OF AMERICA

Professor John W. Burgess in his "Political Science and Constitutional Law," Vol. II, says: "This is substantially *representative* government. In the political system of the United States the state and the government are not identical; *i. e.*, that the government is representative. It is further, *limited* representative government. It is *democratic* representative government." He goes on to say that "it may be characterized as a federal presidential republic. It is a *representative, limited, federal, co-ordinated, elective, presidential, democratic* form of government." Professor Burgess is the highest authority on the subject and his view is here most unreservedly accepted.



THE ENGLISH GOVERNMENT

While it may be more accurate to speak of the British Government than to call it the English Government, still it developed in England and is essentially English. The state and the government in England are identical, and it is Parliament. As there can be no such thing as an unconstitutional Act of Parliament the English Government is *immediate* and *unlimited*. No judge can pronounce its acts as unconstitutional and the liberty of the individual is completely at the mercy of Parliament. While it is

true, that the Crown has an absolute veto this power has not been employed since 1707. It is true also that the Crown can create members of the House of Lords, but this power is really exercised by the Cabinet. Since 1880, about 289 peers have been created and there are over 700 members now of the House of Lords, or more lords than commoners. Moreover, the Crown can promulgate orders having all the effect of law, provided they infringe no Act of Parliament. For all this the English Government is utterly despotic in theory, however liberal it may be in practice.

There is no *federalization* in the British Empire. England rules it. There is no local government which the central government cannot legally modify, change, or even destroy. The government is therefore *centralized*. If we choose to regard the King as Chief Executive and the Parliament as the legislative branch we may say that the government is *co-ordinated*. It is safer to regard it as a compromise between *co-ordinated* and *consolidated*. It is really consolidated.

The English Government is partly *hereditary* and partly *elective*. It is *parliamentary* government, and the House of Commons has complete control of the administration. It is *monarchic*, and *aristocratic* in semblance, and only slightly democratic in reality.

To summarize: The English Government is *immediate, unlimited, centralized*, partly *consolidated*, and partly *co-ordinated*, partly *elective* and partly *hereditary, parliamentary, monarchic, aristocratic*, slightly *democratic*, and in fact *oligarchic*. This last assertion will be found true if we consider the following:

THE BRITISH CABINET

The ministers or cabinet are the chiefs of the party in power in the House of Commons. It may be said to be a committee and the most important committee of the House of Commons. While the right to introduce private bills is inherent in membership, yet the ministers have the sole right to initiate legislation and frame bills. By far most of the legislation originates exclusively with the ministers and their measures are not, as in the French Chamber of Deputies, referred to committees. The ministers are a committee, and the cabinet consists ordinarily of twenty-two members, who sit as said committee. Being administrative heads of departments, they do not all participate in the general sessions.

It follows that the Prime Minister, Foreign Office Minister, and one or two others are the oligarchy which governs the British Empire, although no money bills can be offered to the Commons without the approval of the cabinet as a body. The government is thus a party clique, existing for party ends. Party discipline is very strong and ministers do not like to risk unseating themselves by a new election. There is a further reason.

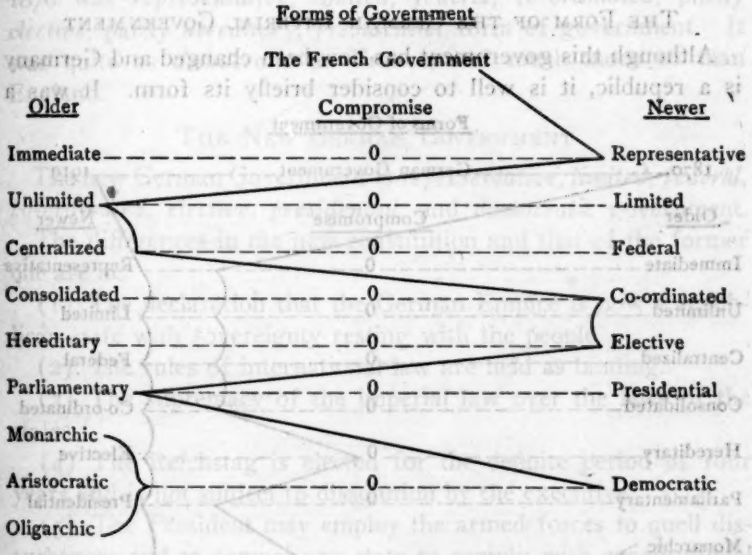
In addition to the twenty-two (22) members of the cabinet, there were, prior to the war, thirty (30) other ministers and fourteen (14) junior ministers. In other words there were, prior to the war, sixty-six (66) ministers of various kinds who went out of office with a change of party in an election. Their average salary was, prior to the war, £2700 ($13,000) per annum. Several positions carry with them a house, furniture, motors or horses, heating, lighting, servants, etc. The Lord High Chancellor, for instance, gets £10,000 per annum, and, if his party goes out of office, he may retire on a life pension of £5000 per annum.

It is interesting to note that during the war there was a coalition Cabinet and all the salaries were pooled and divided equally. There is no getting away, however, from the fact the Parliamentary form of government in England fails to give a continuity of policy, and England is always, as is the United States, in a state of unpreparedness for war through the lack of a steady policy and the mixing of strategic considerations with the exigencies of party politics. National safety being the prime function of government, its efficiency for war may be measured by the qualifications exacted from those appointed to high office. In England the highly trained permanent under-secretaries make this less important in Cabinet positions than with us, but we have a long way to go in our diplomatic missions. We may expect to see some form of federalization come about, as the House of Commons is too unwielding. Some decentralization is imperative in order to properly transact business, and the proposal to create two separate local governments in Ireland is in itself a form of federalization or may easily lead to it.

THE FRENCH GOVERNMENT

The government is *representative*. The state is represented by the National Assembly, which is a very different thing from the Chamber of Deputies and the Senate. The National Assembly

is separate from and supreme over the government, but the "joker" is that the government cannot change the constitution, but the Chamber of Deputies and the Senate may transform themselves into the National Assembly and then change the constitution. The French Government is *democratic* and is *centralized* as there is no distribution of powers between the central governments and the local governments, which may be swept by the central government at will. It is *co-ordinated* because a distinction is made in the constitution between the functions of the legislative and executive departments.



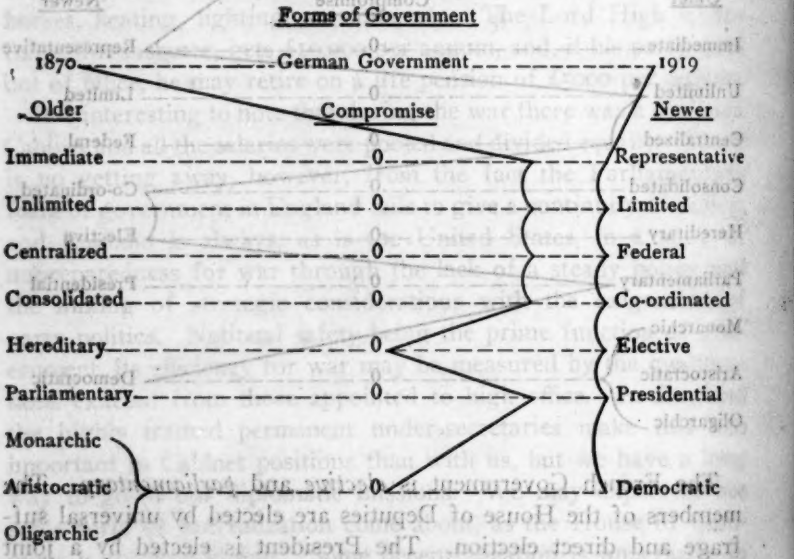
The French Government is *elective* and *parliamentary*. The members of the House of Deputies are elected by universal suffrage and direct election. The President is elected by a joint assembly of the House of Deputies and the Senate and in case of impeachment it is prescribed that the House of Deputies prosecute and the Senate act as a court to try him. Every act of the President must be countersigned by a responsible ministry, but he has no veto power. His administration must be in political accord with the Chamber of Deputies no matter what the political majority may be in the Senate, the constitutional requirement that the ministry must be politically responsible to both chambers is

now a dead letter. The French Senate is without great influence in the French Government.

To summarize: The French Government is *representive, unlimited, centralized, co-ordinated, elective, parliamentary, democratic* government. While France is a republic the despotism of the Chamber of Deputies is undeniable. Thus we find in the Chamber and the Commons of France and England the despotic power bred of the French and English revolutions. (There is really no French constitution but a series of three constitutional laws passed in 1875.)

THE FORM OF THE GERMAN IMPERIAL GOVERNMENT

Although this government has now been changed and Germany is a republic, it is well to consider briefly its form. It was a



representative government. The state and legislative bodies were distinct so that it was not *immediate*. It was a *limited* government because it was limited by the principles of the constitution. It was partly *democratic* and partly *monarchic*. It was a *federal* government exactly as in the case of the United States, the sphere of the *central* government being definitely given in the constitution and the states reserving all powers not mentioned in the constitution as belonging to the *central* government. It was, as

to tenure of office, partly *hereditary* and partly *elective*. It was a *presidential* government as distinguished from a *parliamentary*, as the ministers were appointed by the Emperor and the legislative body had no control over them. As pointed out, the right of the veto of the acts of the Reichstag really rested with the Prussian members of the Bundesrath. The Emperor could adjourn and prorogue the Reichstag, and we may therefore really designate the government as of the presidential form. We may summarize: The German Government under the constitution of 1870 was *representative, limited, federal, co-ordinated,* partly *elective,* partly *hereditary, presidential* form of government. It was quite as *democratic* as France, and much more so than England.

THE NEW GERMAN GOVERNMENT

The new German Government is *representative, limited, federal, co-ordinated, elective, presidential,* and *democratic* government. The differences in the new constitution and that of the former one are in:

(1) The declaration that the German Empire is now a republican state with sovereignty resting with the people.

(2) The rules of international law are held as binding.

(3) The supremacy of the imperial law over the laws of the states.

(4) The Reichstag is elected for the definite period of four years and is not subject to dissolution by the executive.

(5) The President may employ the armed forces to quell disturbances and to compel any state to comply with constitutional requirements, but the Reichstag may veto this power in any given case.

(6) The President's executive acts must be countersigned by the chancellor or a minister.

(7) The Reichstag is given the right to impeach the President, chancellor, or any minister, but the charges must bear the signature of at least one hundred (100) members.

(8) The Bundesrath now becomes the imperial council with the power of Prussia curbed.

(9) The budget system is adopted.

(10) The entire postal telegraph and railroad systems to be taken over by the Empire and the states and the canals may be taken over in case the defense of the country requires it.

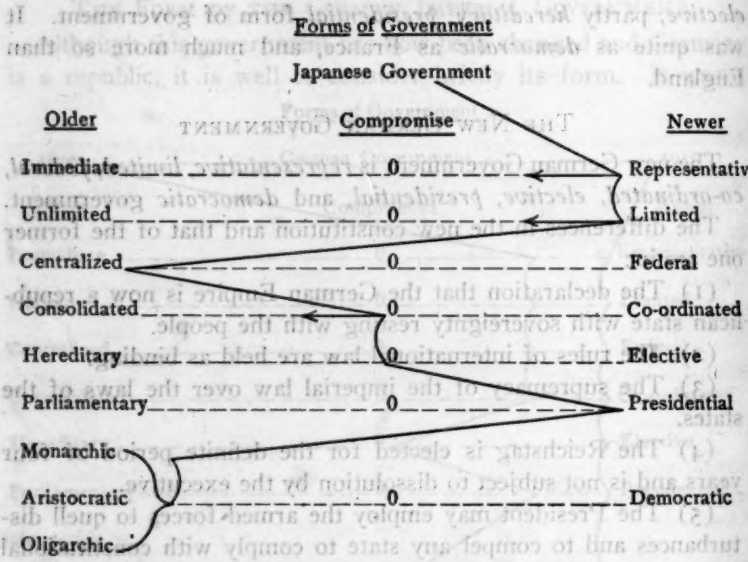
(11) Judges are chosen for life.

(12) Freedom of speech and no censorship except of moving picture films morally.

The new German Constitution is a chastened and model document but it remains to be seen how far it is more than a proposed program of procedure.

THE JAPANESE GOVERNMENT

In theory the Emperor of Japan gave the constitution to his people, and, while the constitution defines the powers of the



Emperor and he is advised by various bodies, such as the Elder Statesmen (the Genro) and the Privy Council, still, the individual members are appointed by him and, also, while the government is *representative* in form, because there is a distinction between the state and the government, yet it is really a centralized autocracy. One writer calls it "bureaucratic and autocratic." However, as the state and the government are not the same, we will have to classify the government as *representative* and as *limited* by the constitution.

The Japanese Government is *centralized*, as there is no trace even of federalization. As the powers are distributed by the con-

stitution between the Emperor and the Diet it is *co-ordinated* in form, but the Emperor really has so much power that the government is almost consolidated. The government would therefore be said to be partly *consolidated* and partly *co-ordinated*. It is also partly *hereditary* and partly *elective*. It is also *presidential* in form and partly *monarchic* and partly *aristocratic*. It is in no sense a *democratic* government, since in a city like Tokyo, of three million (3,000,000) inhabitants, the voting population is about twenty-four thousand five hundred (24,500). To summarize: The Japanese Government is a *representative, limited, centralized, partly co-ordinated,* and *partly consolidated, partly hereditary,* and *partly elective, parliamentary, monarchic,* and *aristocratic* government.

DISCUSSION OF THE FORM OF GOVERNMENT OF JAPAN

Professor Hart says: "Japan is ruled and ruled well. Nowhere can there be found a nation with a more distinct and persistent national policy. No country in modern times is so successful in carrying through great projects step by step. Everywhere there is good order, and everywhere, also, the mark of political power shaping the purposes of the nation." He omits to say, however, that the power that is shaping the purposes of the nation is largely military. Professor Hart also says, very truly, that "government does not rest ultimately on the consent of the governed but on its conformity to the will of the world spirit which makes and unmakes civilization."

It can only be a question of time when Japan will come in collision with the same forces which have compelled the German Government to conform to the will of the world's spirit which makes and unmakes civilization. Unfortunately for Japan she has taken Prussia as her model.

The Emperor reigns over and governs because he combines in his person the sovereignty of the state, descent from the gods, the government of the country and its people, and the political headship of the nation. It is true that his power is exercised through a cabinet and a bureaucracy to which are entrusted the routine of administration. Yet, even the Diet may be dissolved at any time and he has the absolute veto and alone has the right to propose amendments to the constitution. While members may

introduce bills into the Diet, the Emperor may withdraw such bills and amend them. To him belongs the power to organize and re-organize all the departments of the government, to appoint and remove officials, fix salaries, declare war, make peace, conclude treaties, proclaim a state of siege, confer titles, grant amnesty, promulgate ordinances which have the effect of law, and command the army and navy.

The Cabinet does not derive its powers from the constitution but from the Emperor, and it may be said that the Cabinet apparently really governs, since the Emperor has never refused his approval to any law which has been presented to him by the Cabinet. In Japan, as in the former German Empire, the Chancellor, or, as he is called in Japan, the Minister-President, is all in all, and the other ministers are relatively of less importance, thereby building up a political party of which the Premier is the actual leader.

The constitution provides that the Privy Council shall deliberate on matters referred to by the Emperor, but as the cabinet ministers' are *ex officio* members of the Council, the approval of the Emperor to a decision of the Council places it over the Cabinet, which may not question the decision. By incorporating the policy of the Cabinet in the procedure of the Privy Council, no interpolation may take place in the Diet, and thus is nullified the right of interpolation which the members of the Diet have.

In the constitution the Japanese "bill of rights" is incorporated, comprising fifteen articles out of the seventy-six that make up the constitution. These provide equal eligibility to office, liberty to change place of residence, freedom from arrest, trial, and punishment, the right to judicial trial, exemption of the house from liability to search, privacy of correspondence, inviolability of property rights, freedom of religious belief, liberty of speech, publication and association, and the right of petitioning the Diet. But in no instance does the constitution itself declare the conditions by which these precious privileges shall be enforced. In no case does it assign a penalty for the agent who shall contravene one of these rights. In other words, personal rights are not guaranteed. While the Minister-President has general control of the affairs of state, as a matter of fact, however, military and naval officers are authorized to approach the Emperor direct upon affairs of state, and otherwise than through the medium of the Minister-

President, and obtain certain decisions thereon. Questions of military expansion and national defense which are closely related to affairs of state, diplomacy and finance, are really settled outside of the sphere of the Minister-President. The Board of Marshals and Admirals of the Fleet (Gensui-fu) and the Military Council (Gunji Sangi-in) afford special protection to the power of the military element. It is obligatory that the two Cabinet positions of Minister of War and Minister of the Navy, and other high administrative offices, shall be filled by military and naval officers of high rank. In its practical working, this means that the army and navy are able to dictate who shall be Minister of War and Minister of the Navy, respectively, and can use their power in such a way as to destroy any cabinet to which they may become opposed. In a book by the former Minister of Justice in the Okuma Cabinet, Mr. Ozaki Yukio, entitled "The Voice of Japanese Democracy," published in Yokohama in 1918, with an introduction by Marquis Okuma, it is stated that under the present system, military and naval men are empowered to assume any official position whatsoever in addition to those military duties which are properly attached to their profession—that is, they are qualified to be ministers or vice-ministers of education, finance, agriculture and commerce branches of the administration which are removed as far as possible from things military; while at the same time, civilians are absolutely disqualified for the posts of ministers and vice-ministers of war and the navy, and the Governor-General of Korea, Formosa or Kwantung. In the civil service, officials, other than ministers of state, who are personally appointed by the Emperor, are so few in number that they can be counted on the fingers of both hands; but in the military service there are several scores of such, including governors-general of various colonies, commanders of divisions, commanders of naval stations, etc.

Another writer, Mr. Walter W. McLaren, in an article on "Present-Day Government in Japan," which appeared in *Asia* in March, 1919, says:

> When coupled with the rules of the Privy Council adopted in 1894 prescribing the qualifications of candidates for certain high offices, among them the cabinet offices of the army and navy, it has been possible for the Supreme Military Council to control to a large extent the policy of the cabinet. An example may serve to make this matter clear. In December,

1912, the second Saionji cabinet resigned while it enjoyed the support of the majority of the membrs of the lower house of the Diet. The cause of the downfall of the ministry was the defection from its ranks of the Minister of War, General Uyehara, whose resignation came about as a consequence of the refusal of the cabinet to adopt as part of its legislative program for the year an army measure providing for the creation of two new divisions. Uyehara exercised his right to resign, but the Supreme Military Council made the ministry pay the penalty by refusing to detail a qualified officer to take his place, and if the army will not fill the war office in any cabinet, of necessity the minister-president and his colleagues must resign.

The checks exercised by the law-making branch of the administrative department in most constitutional governments are not found in the Japanese system. How far the Japanese Lower House may resist the exercise of arbitrary power from above is difficult to determine, but the refusal to approve a budget may bring on a political crisis, resulting in the downfall of the Cabinet. Under the law, however, the budget of the previous year will remain effective, so that the government may nevertheless continue to have financial support.

As stated previously in regard to the city of Tokyo, only about one in one hundred of the population exercises the right to vote. A great many people do not vote on account of the property qualifications involving also the payment of taxes. At any rate, there is not universal suffrage in Japan. The Cabinet is not responsible as a whole for the acts of individual members; neither are ministers responsible for the acts of the Cabinet as a whole. It therefore follows that the best hope of the people of Japan lies in the *parliamentary* form of government instead of the *presidential*.

CHINA

It is interesting to note that the Provisional Constitution of the Republic of China, adopted at Nanking in 1912, usually referred to as the "Old Constitution," follows the general type of North, Central, and South American republican constitutions, but the "Amended Provisional Constitution" promulgated at Peking on May 1, 1914, resembles in many respects the Japanese Constitution with many modern innovations. The struggle between the partisans of the two may be said to at least contribute to the education of the advocates in the much neglected subject of constitutional law.

CONCLUSION

Modern governments recognize the principle of popular consent and the consequent necessity of having the will of the people ascertained through elected representatives. The representative, however, is not specifically instructed by his electors as to how he shall vote on all questions although he may be elected to represent a special issue but, in practice, he judges questions not only in the interests of his own constituents, but mainly in the light of the needs of the entire community for whose benefit the laws are enacted. The tendency is, however, unfortunately towards courting local favor to insure re-election, and towards combining with others, or what is known as "log-rolling," to secure special local advantages to the pleasure of the local community but to the detriment of the national interests. Debates, or "speeches," in legislative bodies are too often more largely directed to constituents than towards influencing the views of the other members who are supposed to be listening, but, on the other hand, *the efficiency of democratic government depends upon the thoroughness with which every one is willing to test his judgment and opinions in free and open discussion.* Discussions of measures in committees of Congress are too often made behind closed doors, although it is growing to be the custom to take stenographic notes and subsequently publish the proceedings.

It is not easy for a representative to free himself from local interests in order to represent purely national matters, but this at least differentiates a statesman from a politician. We are becoming, in America, more impatient and more accustomed to insisting that problems be met with solutions that bring tangible results, and what is really needed is a business administration by business men accustomed to achieve results by business methods. These standards prevail very strictly in the United States Navy, but no previous training and no examination for fitness is necessary for a minister or an ambassador of the United States to a foreign country, or of a cabinet minister or other appointee to office, other than the ability to be confirmed by the Senate. The re-organization of our diplomatic corps in the matter of appointments and fitness is quite as necessary in relation to the country's efficiency in war as that the form of government should be fit. We pay our cabinet officers and diplomats too little, but we also exact too little in responsible administrative results.

Modern government tends away from *aristocratic, hereditary, immediate,* and *unlimited* government, and towards a *centralized* form of government which is mildly despotic in military affairs, but with responsibility definitely fixed by a responsible and responsive individual or body. There has been a progressive tendency to make the basis of representation exclusive of all adult citizens, and, in some countries, of all adult women as well as men. The original theory of representation was not democratic and was based rather on experience, education, and property-holding. It cannot be said that these restrictions have produced entirely satisfactory results, but universal suffrage is at least impracticable without universal education. Communities, and not individual voters, are represented in the United States Senate, and several small states have only one Congressman and yet have the same number of Senators as the largest and most populous states. In some countries chambers of commerce, the church, educational institutions, and communes are allowed certain representatives. The British House of Commons, as its name signifies, was originally composed of the representatives of communal bodies. The "Mother of Parliaments" developed in England through the summoning to London of representatives of the different communes and classes of citizens to come to an understanding with the crown on the question of taxation and later of administration.

In general, we have seen that the English Government and our government stand at the two extremes of constitutional government with neither country ever prepared for war, but the former German Empire, which the world denounced as an autocracy, was mild as compared with the form of the Government of Japan. Unquestionably, the Japanese Government is the most efficient for war purposes. The British Government is effective to the extent that it is *immediate.* The French Government is effective largely through conscription, but is weak in continuity of policy, and she has constantly been placed in jeopardy by the frequent changes in ministries. Our government may be made effective by divorcing politics from military and international questions, and thus placing the national safety over the exigencies of party politics.

We have seen in each country how constitutions may be modified, and we have seen the many differences between the theoretical and the real government. The great defect in our own government is the absence of definite legislative responsibility. A Con-

gress elected in November does not come in until the following March, and often not until the following December, when the platform on which it was elected has been forgotten. When it does come in it turns the work of legislation over to committees nearly equally divided as to membership between the party in power and the minority. Congress is apt to accept the report of a committee as the verdict of a jury. Work in a committee is naturally not publicly conducted; discussion is more or less limited; there is no definite responsibility; and the time devoted to discussion of a bill in full session of Congress is limited. As, however, bills are considered in both the House and in the Senate, many ill considered and objectionable bills fail in one branch which have passed in the other. For all that, many bills which pass Congress do not receive adequate consideration and, as no member is permitted to allude in the House to anything which has taken place in the committee, log-rolling is made very easy. A single committee should control all revenue and all lump sum appropriation bills, *so that the party in power is responsible.* This implies practically a form of budget system, with committees of Congress interested in detailed expenditures under the different departments and their bureaus.

One of the dangers of the cabinet system to which we are not exposed is the establishment of a vicious circle of professional cabinet ministers who, while apparently opposed to each other in political principles, really take their turn in holding office, so that when one cabinet is overthrown the other comes in with a more or less complete understanding with the government which has just been ousted. This was the state of affairs in Portugal under the monarchy and is under suspicion in several other countries. There is no danger of our getting the parliamentary or cabinet form of government in our country, as the presidential is much more efficient and is strongly intrenched, but a revision of certain features of the Constitution of the United States would contribute to efficiency for war by more definitely fixing the responsibility upon individuals for failure to take proper measures in a given case or for taking measures which prove to be a failure. The right to vote should imply the obligation to bear arms or serve the state in times of national danger. The voluntary system of passing responsibility on to the shoulders of the willing should give place to universal military training and obligation.

As a result of the war some changes may be looked for in forms of government of the Great Powers, especially in regard to treaty-making and the right to declare war. This right must be surrendered to the respresentatives of the people, rather than have it rest in the sovereign or in the cabinet. Likewise, there must be responsibility to the people in guiding international relations. Our own treaty-making methods do not work smoothly at all times, but whatever difficulties we may seem to have, the right to declare war and to make treaties is in harmony with modern tendencies.

It is important to again repeat the pregnant words of Professor Albert Bushnell Hart, "Government does not rest ultimately in the consent of the governed, but on its conformity to the will of the world's spirit, which makes and unmakes civilization."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WHAT IS THE MATTER WITH OPERATING ENGINEERING?

THE QUESTION

By Lieut. Commander H. F. D. Davis, U. S. Navy

1. What is the matter with operating engineering?

2. This question is raised constantly by officers who have watched the development of engineering in the navy. It is held in the minds of all by comparison of the interest shown in operating engineering with the interest in gunnery, such comparison never being to the credit of engineering. It is brought forcibly to the front at the present time by the fact that the personnel situation is such that the navy must begin at the bottom and build up a structure almost entirely new.

From: Commanding officer
To: Commander battleship division. . . .
Subject: Operation engineering, lack of interest in.

1. It is believed it may safely be said that there has never been more competent commissioned engineering talent in the battleship force than is the case to-day. Considering the service of the battleship force, past and present, material engineering conditions are excellent. On the other hand, operating conditions are only fair, and the reason for it is due, it is believed, to the lack of organization for co-ordination in engineering similar to that which obtains on the squadron staffs, and particularly on the force staff, in connection with gunnery. The gunnery officers of the battleship force have the closest sort of liaison organization to the immense benefit of the gunnery work. Due to this intimate association of the gunnery officers, led and guided by the force gunnery officer, not only has each ship reached a position as far as records and data are concerned that at the end of each week the individual ship knows how she stands as far as efficiency is concerned, but the division and force commanders also know, and the other ships of the force, and if any unusual or unforeseen difficulties have been encountered in the other vessels of the force; and efficient standardization of methods and records is thereby determined. On the other hand, the efficiency of naval engineering has not improved in anything like the same degree, if at all, and there is vast room for improvement in operating engineering. This letter does not refer to designing engineering at all. Designing engineering will take care of itself if the policy recommended in this letter is carried out. . . (Signed)

2. Gunnery officers and signal officers have frequent gatherings for the exchange of ideas and for mutual indoctrination. The supply officers sometimes have such meetings, and even the navigators meet occasionally, but so far this cruise there has been nothing of the kind for the engineers. It is one of the hopeful signs for progress, that whereas not so many years ago the engineers might have desired not to have a feeling of neglect, and somewhat of derogation, because of the apparent lack of interest on the part of the flag officers in the personnel of the heads of the engineering department of the ships of the battleship force.

3. But further than this, the gunnery officers are sought diligently, a list of officers possibly good material for the development of the gunnery officers is kept, and diligently scanned and revised. When once found they are watched closely, and the most excellent records of their performances, their characteristics and capabilities are kept and studied. This solicitude is due in great measure to the fact that our sole source of supply for gunnery officers lies in the naval service, whereas it is commonly accepted that an abundant supply of steam engineers can be obtained from civil life. It is true that engine drivers, and engineers of the grade of our warrant engineers, can be obtained in the case of necessity, practically without limit, but the experience of this war has shown that the high-grade engineer, such as those we have among the commissioned engineers of the naval service, is difficult to obtain from civil life, and when found, it takes not less than six months for him to orient himself sufficiently to begin to show ability in a practical form. It is believed to be a fact that nowhere is there a list kept of the available commissioned steam engineers of the service, with records of their performances, qualities, and characteristics, similar to that which obtains in the case of the gunnery engineers; nor will there be until the fleet begins to approximate the interest in the personnel of the engineer officers that now obtains in the case of the personnel of the gunnery officers. It is not too much to say that they are of equal importance.

4. It is desired to emphasize the fact that the staff engineer officer is primarily a personnel officer. Heretofore he has appeared to have been a material officer only. It is not desired to minimize the importance of the material duties of such an officer but it is desired that it be clearly understood that this officer is above all else a leader of men.

5. The lack of interest is not confined to the battleship force. The Bureau of Steam Engineering, the Bureau of Navigation, the Office of Operations, and the Office of Engineering Competitions are equally apparently lacking in interest in this regard, and if the principle of the policy above suggested meets with the approval of the division and force commanders, and of the commander-in-chief, it is suggested that this letter be forwarded to the Navy Department with appropriate comment.

6. It is recommended that an officer of appropriate rank be assigned to all force staffs, and that it shall be his duty to coordinate and direct the efforts of the engineer officers of the force with the mission to determine the highest possible standard of engineering efficiency in the force; particularly operating efficiency.

(Signed).....

THE CONDITION OF ENGINEERING PERSONNEL

3. The conditions of enlisted personnel on January 1, 1920, are shown in the following table:

Branch	In service Jan. 1, 1920	Required for 143,000	Present shortage
Seaman branch	52,996	67,664	14,668
Artificer branch	7,013	11,765	4,752
Engine room force	23,789	41,311	17,522
Engineer force—all ratings	27,436	49,904	22,468
Special branch	7,054	10,600	3,546
Commissary	3,689	6,982	3,293
Messmen	7,139	4,835	2,304 excess
	101,680	143,157	41,477

From this table it is seen that the engineering personnel, including those artificer ratings, usually under the engineer officer of a ship, should be $\frac{49,904}{143,157} = 35$ per cent of the total; 33,282 of the 49,904 should be petty officer ratings. The actual shortage on January 1, 1920, in all the engineer ratings was 22,468. There were only 12,903 engineer petty officers instead of the 33,282 required and many of these 12,903 will probably soon leave the service unless conditions are radically changed for the better. These petty officers are the experienced men, the backbone of engineering personnel of the service, the men upon whom the service relies to train, by personal example and daily intimate association, the new and untrained recruits.

THE NEED FOR AN IMMEDIATE ANSWER

4. The answer to the question raised in this paper should be found and a proper remedy discovered for the trouble affecting operating engineering in order that the problem of building up the operating personnel may proceed more rapidly from a sure foundation and with a vital stimulus forcing officers and men on to better things. The guns of our ships are of no use unless they are put in the proper place and *kept there* by the operating engineers. The best brains in and out of the service are therefore to be enlisted to work on this problem in an effort to get the right answer.

5. It will also be seen from the above table that for a total strength of 143,000, 67,864 men are called for in the seaman branch; and the enlisted engineering personnel should be 73 per cent of this number viz: 49, 904 as stated.

6. Accordingly, in order that the men of the engineer force may be given the same amount of supervision during education and training as is given to men of the seaman branch in their gunnery training, there should be 73 per cent as many officers of equal ability, below heads of departments, assigned to engineering duty as are assigned to gunnery duty. Further, the Secretary of the Navy, the chief of naval operations, the bureaus of the department, the commanders-in-chief, the commanders of squadrons, the captain of each ship and the staff officers of each ship should properly show the same interest in the officers and men of the operating engineer force that they manifest in the officers and men that fight the guns.

7. It is not believed that anyone will dispute the fact that such interest is not now shown. What captain of a ship shows the same interest in the selection of his engineer officers that he shows in the selection of his gunnery officers? What commander-in-chief shows the same interest in the work of his fleet engineer officer as in the work of his fleet ordnance officer? How does the care with which an engineer officer is selected for a ship in the Bureau of Navigation compare with the consideration given the selection of the ordnance officer of a ship?

8. In this connection a study of proposed legislation now being considered by Congress reveals the important fact that extra compensation is to be provided for men to stimulate interest in gunnery, in clerical work, and in commissary work. No mention is made of similar rewards to stimulate interest in engineering!

9. An attempt will be made to show that there are definite reasons for this state of affairs; and the kind of remedy needed will be pointed out.

THE INTEREST IN GUNNERY

10. The care of guns, turrets and ordnance material in general is a relatively simple operation directly comparable to "cleaning stations" in the engineer department and elsewhere in the ship. The preparation for action of guns is a relatively simple and short operation. The active life of a gun, assuming it to be 1000 rounds, is less than as many seconds. During this short time it gets or fails to get all the results that are expected of it.

11. Standardization in ordnance has progressed to a relatively great extent and the quality and characteristics of guns of similar size and design are remarkably uniform.

12. The productive life of a naval gun is divided into periods during which five to ten shots are fired. By the target practice methods developed to date, the results of each period can be definitely computed in hits per gun per minute. This measure of efficiency is direct and easily arrived at. It becomes a part of the records of the men in the gun's crew, of the battery or turret officers concerned, of the gunnery officer, of the Executive and of the Captain. Each of them is, therefore, intensely interested in making as high as possible the "hits per gun per minute" of each of the guns which affects his record.

13. In the active training of guns crews and the units that make up the gunnery organization of a ship the conditions of target practice and actual service of the gun can be and are very closely simulated. Records of the hits per gun per minute can be and are made a part of the daily drills and thus give continuously a direct means of comparison between guns crews, divisions, ships, and larger units of the fleet.

14. A better plan for stimulating interest of all concerned can hardly be conceived. The "hits per gun per minute" make the lever by which gunnery has been raised to its present level of excellence, and the lever which in the hands of interested officers will serve to force progress hereafter.

THE LACK OF INTEREST IN ENGINEERING

15. The productive life of a machine is quite unlike that of a gun. The nearer to 100 per cent of its actual life that can be made productive the better the machine. The cleaning of a machine is a minor, although necessary, part of its life. The repairs to the machine are more or less frequent depending on the conditions of operation. During operation it requires constant attention such as lubrication, adjustment of speed and load, increase of, or decrease of, input, of temperature, etc.

16. Although the engineering material of our ships is uniformly good, standardization in engineering has proceeded to a less degree and the excellence of similar machines on different ships varies in very marked degree.

17. There has not been developed, nor is there in immediate prospect a definite measure of the productiveness of a machine in terms similar to hits per gun per minute. We have not yet developed a convenient, easily understood, easily arrived at measure of efficient performance for each machine. There is no

measure of results of productiveness which becomes an immediate part of the record of the men responsible for the operation of the machine, the supervisory officers concerned, the engineer officer, the executive and the captain. The methods of operation usually shift, partially or completely, the immediate responsibility for proper operation of a given machine each time a watch changes, *i. e.*, every four hours. In consequence, there is no stimulating vital interest in the men or the supervisory officers, extending through the engineer officer and the executive to the captain. In this fundamental point lies the trouble with operating engineering. The engineering competition fails, and has failed, because it does nothing to give a vital interest extending from the man with the shovel or the oil can through the supervisory officers and the captain to the commander-in-chief and to the Navy Department itself. There is now no lever of like value to "hits per gun per minute" which can be put in the hands of interested officers to raise the standards in operating engineering and upon which to base rewards; assuming that proper rewards are forthcoming.

CONCLUSION

18. In propounding the question "What is the matter with operating engineering" and in explaining the lack of vital interest in engineering, a parallel has been drawn with gunnery and gunnery methods.

19. It is not intended to indicate thereby that the vital interest giving element that it sought for engineering can be furnished by the methods developed for gunnery. In view of the great differences indicated above, it is believed that it may be found in a very different way. The finding of this method of stimulating interest in engineering appears to be largely a psychological problem which must have a practical solution found by the navy for itself. The trained psychologist, however, should be able to give valuable assistance.

20. It is confidently believed that a solution of this problem can be found and that, when found, operating engineering will rapidly advance, as it should, and remain thereafter the coequal partner in a growing success of our navy. Such solution cannot come without the careful thought, efforts, and cooperation of all officers who are interested in seeing our navy the leader of naval progress without a peer in all branches of naval endeavor.

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A PROPOSED SYSTEM FOR STIMULATING INTEREST IN OPERATING ENGINEERING

By Lieut. Commander Frederick C. Sherman, U. S. Navy

The defects noted in connection with the interest in operating engineering in another paper in this issue of the Proceedings may be listed as follows:

(1) Lack of an accurate and convenient measure of efficiency of a machinery installation.

(2) Lack of interest in engineering by supervising officers and men.

(3) Lack of a proper competitive feature similar to competition in gunnery.

Further, it is stated that the problem is psychological and that engineering is not recognized in true proportion to its importance in getting the guns into position in battle. If the psychological problem can be solved and if the interest and brains of the personnel concerned are applied to operating engineering in the same measure that they are applied to gunnery, it is believed that operating engineering will advance in step with gunnery and will solve its own problems.

The present methods of engineering competition have outlived their usefulness and have failed to solve the problem for the following reasons:

(1) The competition is based on economy rather than efficiency. Economy is only one feature of efficiency and not even its most important one.

(2) The engineering competition is extended over such a long period that interest lags and, figuratively, the personnel go stale. No athlete would attempt to keep up to A-1 condition and run a race every day in the year.

(3) The present engineering competition sometimes puts a premium on delaying desirable repairs for as long a period as possible in order to save on economy.

(4) The present competition fosters discontent by encouraging the cutting down of fresh water supplies and electric lights and fans to such a point as to cause discomfort or inconvenience to the officers and crew. This fact causes some ships to take little interest in competition as they rightly consider contentment more important than a high place in the competition.

(5) The present competition has no spectacular features, with results immediately visible to everyone on the ship. Such a feature is infinitely more desirable than waiting on endless computations of figures which are usually not available until the end of the competition year, as with the present method of competition.

(6) There is no suitable method of reward for every member of the ship involved in the results achieved.

There may be other elements in the problem, but it is believed that the above comprise the principal reasons for the failure of the present method of engineering competition to achieve the results desired in operating engineering.

To correct the conditions a system of competition is believed necessary which will accord with the following specifications:

(1) It must create interest, rather than discontent, of all hands.

(2) It must not include any features which may result in the cutting down of adequate comforts for the crew throughout the whole year.

(3) It must *measure efficiency* rather than an economy which is liable to become niggardliness.

(4) It must be spectacular enough to arouse the interest of the entire ship's company from the captain down to the lowest seaman and to have results immediately visible to all.

(5) It must be intimately connected with gunnery in order to bring home to everyone the fact that battle efficiency depends both on operating engineering to place and keep the guns in position and on gunnery to hit when so placed.

The following system is proposed as designed to fill the above requirements:

A competition should be established for battle efficiency to comprise both engineering and gunnery features in the same

competition. Base this competition on the ability to place the guns in position and on the ability to hit with the guns after being so placed. In order to accomplish this, the knots per ton of fuel, best performance, should be established as a standard for each ship. Then figure out a standard number of miles to be steamed for the battle target practice. Assume this is adopted as 40 miles. Then assign to each ship for its battle efficiency practice, the exact amount of fuel required to steam 40 miles at the rate of its standard of knots per ton established from its best performance, and allowing for a certain period of full speed, say one hour and the balance at economical cruising speed. Umpires would be appointed to measure out the amount of fuel allowed and observe the operation of the ship. Then have the ship start its approach from a point accurately a certain distance, say 25 miles, from the target. Require the ship to steam at full speed for one hour at some time during the run (establish the full speed revolutions as a standard for each ship) and at its economical speed (discretion of each ship) during the rest of the run, proceeding all the time toward its target. Let it fire its guns if it gets into position and continue steaming until its allowance of fuel is expended and then stop. Its score for engineering would be its percentage of the established number of miles (based on revolution curve) obtained from its fuel allowed. In other words, a ship which steamed only 30 miles would get a score of 75 per cent. A ship which steamed 40 miles would get 100 per cent. If a ship exceeded its best performance and got more than 40 miles, it should be credited with a multiple correspondingly greater than 100. In connection with this competition, the starting points of the target and of the firing ship should be a definite distance apart and the course and speed of the target should be unknown, although to make the competition even, the component speed of the target along the base course should be the same for all vessels of a class. In addition to steam used in main propelling plant, the ship should be required to run all the auxiliaries required for battle and to make a certain quantity of fresh water depending on the evaporating plant installed.

Under this competition, if the ship failed to reach the firing point before her fuel allowance was expended, she would have to stop and would not even get a chance to fire her guns. Of course she could be allowed to fire her guns in a separate run for training purposes but such firing would not count in the competition.

Then I would recommend that the entire prize money be divided among the whole ship's company somewhat on the share system as established in the old days of prize money for capturing valuable merchantmen. Allow a battle efficiency prize to the ship standing one of $10 per share. Give all non-rated men on the ship 1 share, third-class petty officers 1½ shares, second-class petty officers 2 shares, first-class petty officers 2½ shares and chief petty officers 3 shares. For the ship standing two, the same system would be followed except the value per share should be $5 and for the ship standing three, the value per share would be $3. In addition, I would recommend that a letter of commendation be given to every officer, commissioned and warrant, attached to a ship to which a prize is warded for the enlisted men. The present system of picking out three or five officers for commendation is positively harmful in that it causes many heart burnings and jealousies, whereas it is frequently utterly impracticable to limit the list of officers contributing to the success of a ship to the three or five allowed. Every officer on a ship has more or less responsibility for the success of a ship, according to his rank and assignment to duty, and should partake in the rewards. To discriminate between them is not always easy and it is recommended that every officer on board be eligible for a letter of commendation, always provided, of course, that the commanding officer approves.

Extra pay should continue to be given to gun pointers who qualify but should also be given to those engineering ratings which are most important in operating engineering, subject to a qualification based on the ships performance in the competition.

This competition would furnish spectacular features in that every person on the ship would be interested and would see approximately how many miles the ship had steamed. Its score would be known immediately upon the completion of the run. And what a visible result would be apparent if a ship had to stop either before or during firing because she ran out of fuel! Or had a breakdown! It would be a most emphatic and visual reminder to all hands that battle efficiency depends both on operating engineering and on gunnery.

This system would also tend to unite the interests of both the deck force and the "black gang" in that both would depend on each other for prize money and would be personally interested in

the others' performance. It is believed that this system would tend to eliminate what is too often the case, friction between the engineer's force and the deck force.

This system also would not tend to create discontent as it would be unnecessary to shut down on quantity of fresh water issued or on electric lights or ventilation, during the rest of the year, as these things would cut no figure in the competition. But constant training to *get the most out of a pound of fuel* would be required in order to have competent personnel for the competition when it came. And in the last analysis, that is really what is to be sought after. In addition it would require constant attention to the condition of material in order to train the personnel to get the best results. This feature could be stimulated in addition by causing the time when the competition would be held to be unknown to the ships, within a reasonable notice.

This competition would resemble that of an athlete training for a race. His supreme trial or test would come only occasionally, but for him to make a showing in that test would require his constant training and preparing himself to be in condition for the race when it came.

Many details of such a competition would have to be worked out further than outlined above. The principal features should be those given. It might be desirable to have a primary engineering competition similar to short range target practice for the purpose of giving certain engineering ratings an opportunity to qualify for extra pay as mentioned previously. Such a primary competition could be similar to the one outlined above only restricted to one speed, either full speed or economical speed as desired.

To make this system of competition effective would require that the present engineering competition be abolished entirely and the suggested one substituted. Gunnery competition should be carried out as at present except that the present battle practice (long range gunnery practice) rules should be re-written to conform to the engineering requirements recommended herein. Short range target practice should be restricted to a practice to qualify gun pointers for extra compensation. Prize money for this practice should be eliminated and only awarded to the ship as a whole on its performance in the battle efficiency competition. A similar primary engineering practice might well be held to qualify lead-

ing engineering ratings for extra compensation, based on the ship reaching a certain standard of performance.

This suggested method of competition could be worked out in an infinite number of ways to apply it practically to the service. But the essential point is to have for the engineering competition basis, how far a ship can go on a given quantity of fuel, and for the test to be in connection with gunnery exercises. It can be applied to any class of vessel, of any kind of power plant. It makes a spectacular, sporting event which will arouse the interest of every one on the ship, and the results are immediately visible.

It is believed that a competition such as above would overcome the defects of the present system, would stimulate the interest of everyone on board ship, and would present a fair and equitable measure of the efficiency (as opposed to economy) of the engineering performances of all ships. Every man operating a piece of machinery would be personally interested in obtaining efficient results from the machine and as low consumption of power put in, compared to power obtained, as possible.

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SHORT RANGE BATTLE PRACTICE FOR THE ENGINEERS OF THE NAVY

By COMMANDER H. R. GREENLEE, U. S. Navy

In other papers in this issue of the PROCEEDINGS, there appear discussions of reviving, creating and stimulating interest in engineering matters in the navy, particularly afloat and as affecting both officers and enlisted personnel.

To effect this for officers requires undoubtedly a different system than it does for men. The man has selected his work along engineering lines and wants to do that class of work but he frequently fails in getting the best results through his own personal characteristics, unfortunate assignment to station by the engineer officer, lack of proper training and hence lack of knowledge as to proper operating conditions, and how to make a machine operate economically. He may and probably will be perfectly satisfied if the machine operates without breaking down, but as for efficiency of this operation he has no measure and probably in most cases he will give it little, if any, thought. To improve his point of view, *i. e.*, to make him one of the firm, it is only necessary to measure the efficiency of his work and establish a suitable reward worked out on a competitive basis, affecting not only the individual but affecting the ships as a whole.

The problem of reviving, creating and stimulating interest in engineering among the officers is a different matter. Many officers forget the fact that they, each and every one, must be engineers first, last and all the time. This does not necessarily mean expert electricians or expert turbine operators or designers, but it does mean engineers in the broad terms of the meaning of the word, *i. e.*, "the science and art of directing the great sources of nature to the use and convenience of man." The major division of engineering used by the line officers of the navy are mechanical and electrical engineering, and no officer is fully quali-

fied to perform any duty afloat unless he is fully aware of the fact that he must have and then actually obtains a good general knowledge of engineering as it pertains to the ship on which he is serving. It frequently happens that an officer believes that he can follow a naval career "on deck" with no experience with the "engineers" and thus better fit himself for executive command, *i. e.*, the commander-in-chief of the most important fleet. The fallacy of this is that the individual overlooks the fact that matériel, personnel and operations of ships and fleets go hand in hand, that an engineering education coupled with engineering experience below definitely establishes a habit of accurate, sequential thought, which coupled with a familiarity with matériel matters of the ship or of ships in general, will go farther than is ordinarily believed toward fitting one for executive command.

Officers frequently shun engineering duty afloat for they know that unless they are to become permanent engineers, they must give it up upon reaching the rank of commander and that, if they have had a preponderance of engineering duty, they may fail in being selected for promotion, and that, at any rate, they feel that they are out of touch with deck work and therefore will not be prepared to go as executive officer of a ship or in command of a smaller ship. This, of course, may be true if the officer so elects, but the writer knows of officers who when engineer officer of a dreadnaught spent hours (which otherwise would have been leisure ones) around the bridge when underway, or on deck or discussing "top-side" methods and theories with the Captain, executive officer, gunnery officer and navigator, thus keeping in touch with the ship as a whole and preparing themselves for executive officer duty. It would indeed be unusual in such circumstances if an engineer never found opportunity to give some valuable suggestion to the deck people.

It is hoped that the law restricting the rank of engineer officers of ships to that of lieutenant commander and below will be amended to permit a continuance of this kind of duty by commanders at least.

A plan of requiring an officer to have had a certain definite amount of duty afloat as head of department before being selected for promotion would cure the fear of not being selected. That is, an officer should have a definite amount of duty as gunnery officer or engineer officer, and as first lieutenant or navigator. It

might be any one of the following four combinations: gunnery and navigator, gunnery and first lieutenant, engineer and navigator or engineer and first lieutenant.

It is believed that interest in engineering among officers will be revived, created or stimulated by the publishing by the department of a definite statement showing under what conditions of satisfactory general service and amount of duty of the various kinds that an officer must have, this to insure that he will not be hampered in preferment for promotion if he be disposed to follow engineering work.

It has been previously stated that the reviving or creation of interest in engineering, in the cases of the enlisted man, is not ordinarily necessary, for his interest and desire for knowledge does not, ordinarily, go beyond the engineering department. It is, however, frequently necessary to stimulate the man's interest. To stimulate his interest, the engineer officer and his assistants should study the man's personal characteristics and decide on the best method of handling him, for some men will act carefully and thoroughly on a suggestion, even endeavoring to forestall the issuance of definite instructions, whereas others will require a "cussing out" and the other men of the engineering department will be graded all the way between the two extremes. The end to be arrived at is to endeavor to get the work done, done willingly and at the same time boosting the job, the division officer, the engineer officer, the captain and the ship.

In the study of the individual to ascertain the correct method of handling him, and the final decision as to the method, his contentment and desire to accomplish will be stimulated by being bossed in the exact manner desired by him; now, if during this character study period, a decision be reached as to just the kind of duty for which the man is best fitted and along just what line he is striving and then assign him to it (there is, ordinarily, a niche somewhere on board ship into which each man can be happily fitted), a tremendous stimulation will have been administered.

One of the other papers states that it is impossible for an individual to apply himself with higher than average efficiency day in and day out without growing stale. This is true unfortunately and therefore, a periodic stimulus must be administered. In gunnery we have target practice. The gun or turret crew qualifies

for prize money and additional compensation on short range battle practice. In another paper, it has been recommended that the present method of figuring engineering competitions be discontinued and that long range battle practice be coupled with a full power and economical speed trial with full allowances for them and the ships score be a combination of the engineering and gunnery scores. It is believed that this is only proper, for, if the engineers cannot place the ship for the use of its guns then the value of the guns is reduced accordingly.

It is believed that there should be a competition in the engineering department on which to base awards of prize money and extra compensation corresponding in effect to short range battle practice. The competitions might well be held semi-annually, thus periodically furnishing a stimulus to personnel to actually get all machinery in its most efficient physical condition and therefore its most efficient operating condition as well as to study the method of how to operate most efficiently.

Along this general line a competition was recently held in the destroyer force, Atlantic fleet, in evaporator operation and the scores were published giving the standing by ships and evaporator operators. The results of this test were very interesting, in spite of the fact that perhaps many of the operators were inexperienced, but this test would appear to show conclusively that operators of machinery and apparatus afloat are not generally well instructed in their duties nor are they themselves studying and working intelligently toward increasing operating efficiency. It is very probable that if another competitive test is held within two or three months, the results will be striking. Thus it is, that physical condition and operating efficiency of machinery can be materially improved by a demonstration of such condition or efficiency and further improved by a competitive demonstration of such conditions and efficiencies.

The engine, pump, boiler and other engineering machinery on board ship is designed to have a certain water rate, evaporative efficiency, etc., and upon completion, test of the new machinery develops a certain efficiency which is established as the standard for that piece of machinery. A test of the individual machine at some subsequent time will determine its relative efficiency. Would it be a stimulant to a machinist's mate to know that if his pumps or his generators operated on test to say ninety-five (95%) per

cent of the standard efficiency that he would have five ($5) dollars per month added to his pay for the succeeding six months or that Tom Smith on the sister ship in charge of the same machinery only obtained ninety (90%) per cent efficiency on his pumps or generators? What efforts would be made to keep his pump water end valves tight, his piston rings and plunger packing in good condition, his steam valve mechanism in working order, the stroke of the pump properly adjusted? What thought would the machinist's mate give to getting or keeping the pump in perfect condition, what amount of study would he make of the details of the pump?

If the thought, study of and work on the pump were extended to all enginering machinery on the ship coupled with the stimulus of knowledge of the approach of the efficiency test and the desire to obtain the addition of a definite sum of money to his pay what would be the effect on the enginering efficiency of the ship, the fleet and the navy, and hence the efficiency of the whole navy? It would mean that the machinery of the navy was being operated by a force of thinking men, each striving to excel with semi-annual outbursts of enthusiasm causing increased thought, extra study and work with perhaps a falling back in efficiency subsequent to passing the peak of the tests, but never reverting even to the standard of efficiency that existed prior to the test. The effect would be marked. There would be less navy yard work to be performed with the incident expenditures of funds reduced, the operating cost of ships, in fuel, water and oils, would be reduced, the steaming radius of ships increased and the vessels of the fleet better fitted for the supreme moment than could be effected in any other manner!

The cost of the additional pay and prize money would be almost nothing as compared to the immense saving that would be netted to the government, in expenditures for repairs and extra fuel, etc. In fact the additional advantage of a force of harder thinking and more resourceful men plus the additional steaming radius and reliability of each ship would have a sufficient military value to discount all thought of cost.

The task of planning, preparing for and holding the proposed efficiency tests is acknowleged to be a large one but the difficulties are not unsurmountable, in fact no additional apparatus to that now on board each ship is considered necessary, other than some

means of actually measuring the total water used (not make up feed water) in driving the ship at designated speeds, necessary deductions being made therefrom, to obtain the water rate of the main engines, all other tests may be made at anchor.

It is, indeed, unfortunate that to date satisfactory steam flow meters have not been devised for marine use; however, there is nothing new in making efficiency tests of machinery with such apparatus as is now in the main, provided, for various individuals have on their own initiative been engaged in such investigations of heat losses for many years.

The purpose of this paper is to propose and discuss in general terms, the scheme of holding periodic efficiency tests of machinery with its attendant rewards to officers and men, this system with the proposals made elsewhere in this issue of the institute to supplant the present system of engineering competitions and thereby to establish a competition directly productive of real efficiency entirely through the education of the operating force into a thinking, working, boosting bunch of men.

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NIGHT SCOUTING WITH LISTENING DEVICES

By Lieut. Commander Holloway H. Frost, U. S. Navy

All methods of scouting in use to-day rely upon the actual sighting of the enemy ships. This fact makes it practically impossible to scout during night or while in a fog. The chances for a successful search are also considerably reduced by the haze or mist which frequently reduces the visibility to five or even two or three miles. When darkness comes on, when fog is encountered or when the visibility is so decreased by mist that the area between any two ships on the scouting line cannot be covered, not only must the scouting line cease its advance, but it must retire at the assumed speed of the enemy. The fact that we can scout but 12 hours in 24 on the average in itself reduces the efficiency of the search by one-half. In addition to this, heavy fogs are very frequent off the North Atlantic and the Pacific Coasts of the United States, and in the North Atlantic misty weather prevails almost continually. The difficulty of scouting off the North Atlantic Coast was one of the most important facts demonstrated by the fleet maneuvers held in August, 1916; for a period of four days the visibility varied from four to eight miles and efficient scouting operations by the defending force were consequently impossible.

A typical search by the out and in method is shown in Fig. 1. At daylight a line of six scouts spaced at 40 miles is in position AF. During the daylight period of 12 hours it advances at the speed of 20 knots a distance of 240 miles to a position $A'F'$. Then, as scouting during darkness with the vessels spaced at 40 miles is impossible, the line must retire at 10 knots, the assumed speed of the enemy, for 12 hours. By daylight a retirement of 120 miles has been completed and the line is in position $A''F''$. During the entire period of 24 hours only 120 miles have been made good to the front, although 360 miles have been steamed at the average

speed of 15 knots. Fuel expenditure is a very important factor in scouting operations and if only 120 miles can be gained by 360 miles of steaming, the scouting force cannot expect to accomplish very much before it must return to its base to replenish its fuel supply.

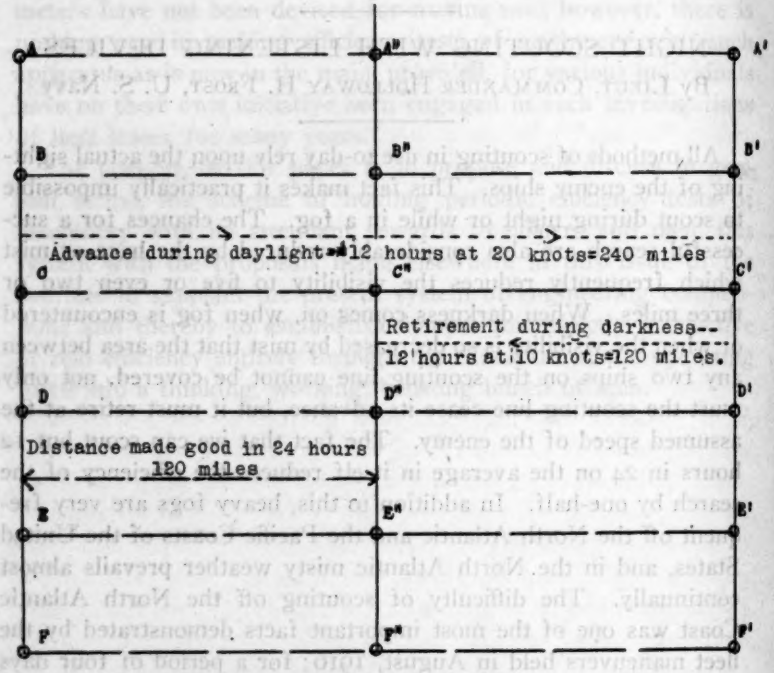

FIG. 1.—Out and In Method.

Assumed Speed of Enemy = 10.
Distance Steamed by Scouts in 24 Hours = 360.
Average Speed of Scouts = 15.
Distance Made Good in 24 Hours = 120.

It is apparent that the greatest advantages would be gained if some method of search could be developed so that scouting could be continued during darkness or fog in the same manner as it is carried on during fine weather in daylight. A possible way of continuing the search would be to use for locating enemy ships the listening devices developed for the anti-submarine warfare.

Rear Admiral E. A. Anderson, U. S. Navy, commanding the American Patrol Detachment, was the first to develop and test out the idea of using listening devices for scouting. As com-

mander of the submarine chaser squadron attached to his command I assisted in the development of this idea. The 12 chasers of the Squadron were exercised continually in listening for surface craft. It was made the normal procedure for chasers proceeding on an exercise cruise to form a scouting line at distances of about 10 miles for the purpose of conducting a night search for the numerous merchant vessels which are continually passing through the Florida Straits. After the scouting line was formed it was the doctrine for chasers to stop for the first 15 minutes of each hour for listening. The K-tube was put over in about 5 minutes; a listening period of about 8 minutes was then allowed; and the tube was hauled aboard in about 2 minutes. If there was reason to believe that vessels were within about 5 miles, the SC and MB tubes, which are fitted in the hull and can be lowered in a few seconds, were also used. For the remaining 45 minutes of the hour the chasers proceeded at 12 knots. A special code was issued for reporting bearings, for informing the squadron commander of the action taken by individual chasers and divisions, and for allowing the squadron and division commanders to give instructions for the scouting line.

In general the actual results obtained in these exercises were not so satisfactory as to prove that an efficient search can be made during darkness with the present design of K-tube. Sometimes bearings accurate to within five degrees were obtained of surface craft distant from 12 to 14 miles; in other cases vessels only 5 miles distant could not be heard.

The operation of listening devices is a very delicate process. Wide variations must be expected in the results obtained. In the first place the skill of the listener is a very important factor and a great amount of experience is necessary if the devices are to be used with real effect. An experienced listener will hear a vessel two or three times farther away than will one who has had only a short training. Also the skill of a listener varies on different days. On one day he will hear a vessel at 8 miles; the next day he will fail to hear the same vessel at 4 miles under the same conditions. The tubes themselves are delicate and no two will have the same degree of sensitiveness. They are also liable to go completely out of commission at any time. The degree of roughness of the sea has a considerable effect upon listening, and even when the sea is calm and when conditions are apparently the

same there seem to be important differences in the distances which can be heard, perhaps due to currents or eddies in the water, differences in temperature, the conformation of the bottom, or the depth of water.

Night scouting with listening devices will hardly be successful until it is possible to detect surface craft with a reasonable degree of certainty at a distance of 15 miles even under bad conditions. Possibly there are devices now which will accomplish this when skillfully used; if not, there is no reason why they cannot be developed. Since the signing of the armistice interest in the development of listening devices has waned; they were designed for use against submarines and now that the submarine campaign is over little attention has been given to them. It is true that another submarine campaign on commerce, such as was carried on by the Germans, will probably never be repeated in the future. But still the submarine will play an important part even if it is limited to attacks on men-of-war. This is well shown by what happened when the Grand Fleet was drawn into the submarine trap of 19 August, 1916. At least 14 torpedoes were sighted by British ships. The *Falmouth* was hit by four torpedoes and the *Nottingham* by three; both ships being lost. There were no less than 22 reports of submarines being sighted. The British submarine *E-23* torpedoed the *Westfalen*; the ship, however, succeeded in making port.

But while we will always need listening devices for use against submarines, they have a far wider field open to them in scouting, reconnoitering, screening and in making destroyer attacks. In order to stimulate the material development of the listening devices, it is proposed to show the advantages which can be gained by their use in night scouting. In order to show how they may be used when once developed, the detailed methods of night search which may be employed will be set forth.

While there are many forms of scouting operations, in nearly every case some form of the out and in method or of the retiring search patrol are used. We will therefore see how listening devices can be used in these forms of search. For the purpose of discussion let us assume that the listening devices are effective at a distance of 15 miles. It is not pretended that there is any distance at which you can always hear a vessel any more than there is a distance at which you can always see one. But in

solving a scouting problem it is necessary to make certain assumptions. In order to be able to assume a listening range of 15 miles, we would want to be certain that the devices would be effective at that range about 8 times in 10 under all weather conditions. Then, when you consider that the chances are very small that an enemy vessel will pass exactly midway between two scouts and that even then two scouts would have to miss it for it to pass through undetected, we could consider the scouting operation 95 per cent efficient and feel that in giving the enemy 1 chance in 20 to get through we would be taking a perfectly legitimate risk. In the sketches of the scouting operations, we invariably assume that the enemy is making a long cruise and is proceeding at 10 knots. In the tables, however, the figures for enemy speeds of 12 and 14 knots are given.

Now let us take up the out and in method. Assume that at sunset a scouting line arrives at the position $A'F'$ in Fig. 1. Instead of retiring during the night, we desire to advance the line still farther to the front or at least to maintain it in this position. If the scouts are spaced at 30 miles, they can lie dead in the water during the entire night and by constantly listening for the enemy maintain their position without expenditure of fuel. If they are spaced at more than 30 miles, each scout must cruise back and forth along the scouting line, in a way which will be described later, if the line is to be maintained. If the scouting distance is less than 30 miles, then the scouts can advance the line to the front either by proceeding on constant courses of by steering a zigzag. The efficiency of the night search therefore depends to a very great extent upon the scouting distance. It will be shown later that, while favorable results will be gained if the scouting distance is less than 30 miles, the solution is not so satisfactory for distances over 30 miles. This at first might appear to be a very important disadvantage. In order to clearly define the situation, it will be well to see what scouting distance can be used in out and in scouting in actual war or maneuvers with actual ships.

At the War College it is assumed that single ships can be seen at a distance of 14 miles and that the smoke of formations of more than eight ships can be seen at 25 miles. In clear weather it is probable that single ships can be seen at 14 miles. The assumption that a formation of ships can be discovered at a dis-

tance of 25 miles depends upon the fact that a large number of ships creates a great mass of smoke which can be seen long before the ships themselves can be seen. Even with coal burners it seems rather doubtful that formations of ships can be seen at the distance assumed even if the weather is perfect. With oil burners—which will run smokeless in order to prevent detection—it would seem that 20 miles would be about the maximum distance at which the sighting of a formation of ships could be counted on. Therefore, for reasons of visibility alone, 40 miles seems the maximum distance at which scouts should be placed even in perfect weather. When it is considered that, except in tropical waters, there are comparatively few days of perfect weather, 30 miles would seem the usual scouting distance and this would frequently be reduced to 25 or even 20 miles. It will seldom be desirable to use a scouting distance just double the distance of visibility; a commander of a scouting line will always wish to have a factor of safety on his side; ships may break down, especially if run at high speed, radio communication may fail, vessels may be sunk or driven out of position by the enemy, and may lose their assigned position on account of unavoidable errors in navigation. Thus, excepting the length of line covered, every advantage is on the side of the closely spaced scouting line. There is more chance of sighting enemy ships, radio communication is better—thus increasing the rapidity with which reports of contacts can be made to the scouting line commander and the readiness with which he can maneuver the line—vessels attacked by superior forces can receive assistance quicker from adjacent ships, more reports of enemy forces encountered will be made—thus fixing the position of enemy screens from which an estimate of the position of the enemy main body can be made—and a force of ships from the scouting line can be concentrated quicker for an attack upon enemy scouts or a thrust through their line into the probable position of the enemy main body. For all of these reasons the scouting distance should usually be kept below 30 miles. For such distances the search can be continued during the night almost as efficiently as during daylight when our listening devices are effective at a distance of 15 miles.

If the scouting distance is just 30 miles the scouts can maintain their position dead in the water during the night, so that for the total period of 24 hours and advance of 240 miles will be made

at an average speed of 10 knots In the usual out and in methods the advance was but 120 miles for an average speed of 15 knots.

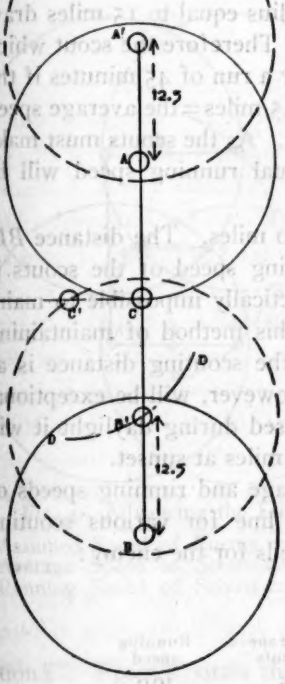

FIG. 2.—Maintaining the Line.

Assumed Speed of Enemy = 10.
Average Speed of Scouts = 12.5.
Running Speed of Scouts = 16.6.

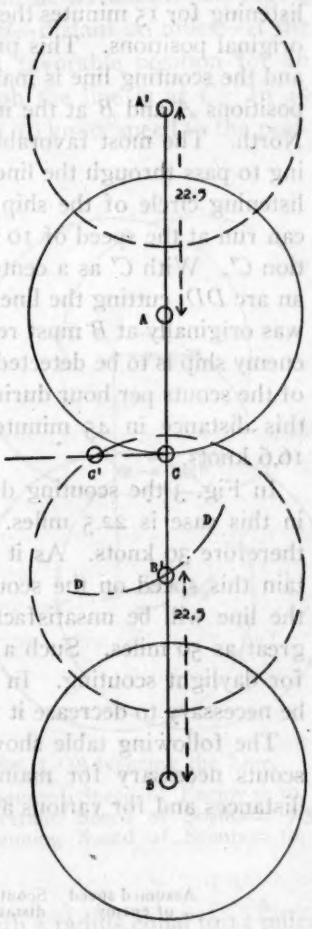

FIG. 3.—Maintaining the Line.

Assumed Speed of Enemy = 10.
Average Speed of Scouts = 22.5.
Running Speed of Scouts = 30.

Next assume that the scouting distance is 40 miles. In Fig. 2 two ships are at *A* and *B* distant 40 miles. After listening for

15 minutes in these positions, they proceed North to positions A' and B' in the remaining 45 minutes of the hour. Then after listening for 15 minutes they proceed South for 45 minutes to their original positions. This procedure is continued during the night and the scouting line is maintained. Assume that the ships are in positions A and B at the instant of getting under way on course North. The most favorable position for an enemy ship attempting to pass through the line undetected is at C, on the edge of the listening circle of the ship at A. In 45 minutes the enemy ship can run at the speed of 10 knots a distance of 7.5 miles to a position C'. With C' as a center and a radius equal to 15 miles draw an arc DD, cutting the line AB at B'. Therefore the scout which was originally at B must reach B' after a run of 45 minutes if the enemy ship is to be detected. $BB' = 12.5$ miles = the average speed of the scouts per hour during the night. As the scouts must make this distance in 45 minutes their actual running speed will be 16.6 knots.

In Fig. 3 the scouting distance is 50 miles. The distance BB' in this case is 22.5 miles. The running speed of the scouts is therefore 30 knots. As it will be practically impossible to maintain this speed on the scouting line, this method of maintaining the line will be unsatisfactory when the scouting distance is as great as 50 miles. Such a distance, however, will be exceptional for daylight scouting. In case it is used during daylight it will be necessary to decrease it to about 40 miles at sunset.

The following table shows the average and running speeds of scouts necessary for maintaining the line for various scouting distances and for various assumed speeds for the enemy:

TABLE 1

Assumed speed of enemy	Scouting distance	Average speed of scouts	Running speed
10	35	7.5	10.0
10	40	12.5	16.6
10	45	17.5	23.3
10	50	22.5	30.0
12	35	8.5	11.3
12	40	13.5	18.0
12	45	18.5	24.6
12	50	23.5	31.3
14	35	10.5	14.0
14	40	15.5	20.7
14	45	20.5	27.3
14	50	25.5	34.0

Now let us consider cases where the scouting distance is less than 30 miles and the scouting line can be advanced. In Fig. 4 assume that two scouts are at *A* and *B*—distant 20 miles—at the end of a listening period. The most favorable position for an enemy ship attempting to pass through the line is at *C*. In 45 minutes this vessel can run 7.5 knots at 10 knots speed to the posi-

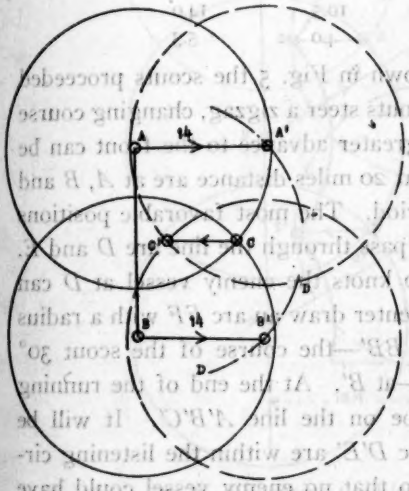

FIG. 4.—Advancing the Line.
Assumed Speed of Enemy = 10.
Average Speed of Scouts = 14.
Running Speed of Scouts = 18.6.

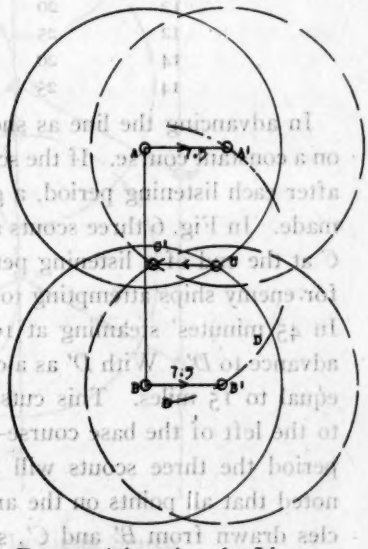

FIG. 5.—Advancing the Line.
Assumed Speed of Enemy = 10.
Average Speed of Scouts = 7.5.
Running Speed of Scouts = 10.

tion *C'*. From *C'* draw the arc *DD* with a radius equal to 15 miles cutting *BB'* at *B'*. The ships at *A* and *B* can therefore advance 14 miles to *A'* and *B'* during the running period of 45 minutes. The average speed of advance is therefore 14 knots per hour and the running speed will be 14 x 4/3 = 18.8.

In Fig. 5 the scouting distance is 25 miles, the average speed of advance is 7.5 and the running speed is 10.

The following table shows the average speed of advance and the running speed of the scouts for various speeds of the enemy and various scouting distances:

TABLE 2

Assumed speed of enemy	Scouting distance	Average speed of advance	Running speed
10	20	14.0	18.6
10	25	7.5	10.0
12	20	12.0	16.0
12	25	6.0	8.0
14	20	10.5	14.0
14	25	4.0	5.3

In advancing the line as shown in Fig. 5 the scouts proceeded on a constant course. If the scouts steer a zigzag, changing course after each listening period, a greater advance to the front can be made. In Fig. 6 three scouts at 20 miles distance are at *A*, *B* and *C* at the end of a listening period. The most favorable positions for enemy ships attempting to pass through the line are *D* and *E*. In 45 minutes' steaming at 10 knots the enemy vessel at *D* can advance to *D'*. With *D'* as a center draw an arc *FF* with a radius equal to 15 miles. This cuts *BB'*—the course of the scout 30° to the left of the base course—at *B'*. At the end of the running period the three scouts will be on the line *A'B'C'*. It will be noted that all points on the arc *D'E'* are within the listening circles drawn from *B'* and *C'*, so that no enemy vessel could have passed through undetected. The average speed of the scouts per hour (*BB'*) is 21 knots. Their running speed is 28 knots. The average speed of advance—the distance between the line *AC* and the line *A'C'*—is 18.4 knots. After listening for 15 minutes at *A'B'C'* the scouts proceed on a course 30° to the right of the base course to *A"B"C"*. When a zig-zag is steered a greater advance can be made to the front (18.4) than when constant courses are steered (14). However, the average speed of the scouts is 21 against 14 and the running speed is 28 against 18.6, thus showing that it is a far less economical method of search. There will, however, be cases where the rapidity of advance is more important than economy and then the zigzag search will be used.

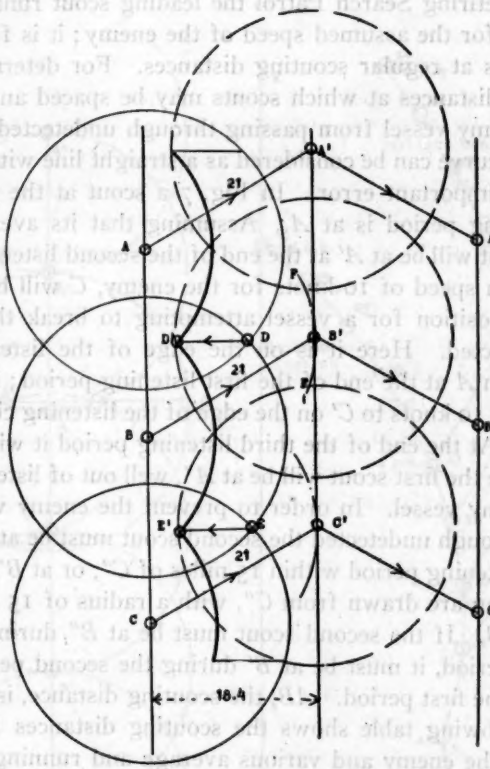

FIG. 6.—Advancing the Line by Zigzag Search.

Zigzag 30° from Base Course.
Assumed Speed of Enemy = 10.
Average Speed of Scouts = 21.
Running Speed of Scouts = 28.
Average Speed to the Front = 18.4.

The following table shows the running speed, the average speed of scouts and the speed of advance of a 30° zigzag for various speeds of the enemy and various scouting distances:

TABLE 3

Assumed speed of enemy	Scouting distance	Average speed of scouts	Running speed of scouts	Speed of advance of the line
10	20	21	28	18.4
10	25	18	24	15.5
12	20	19	25.3	16.7
12	25	16	21.3	13.5
14	20	17.5	23.3	15.4
14	25	13	17.3	11.5

In the Retiring Search Patrol the leading scout runs the retiring search for the assumed speed of the enemy; it is followed by other scouts at regular scouting distances. For determining the maximum distances at which scouts may be spaced and still prevent an enemy vessel from passing through undetected, the retiring search curve can be considered as a straight line without introducing an important error. In Fig. 7 a scout at the end of the first listening period is at A. Assuming that its average speed is 15 knots it will be at A' at the end of the second listening period. Assuming a speed of 10 knots for the enemy, C will be the most favorable position for a vessel attempting to break through the line undetected. Here it is on the edge of the listening circle drawn from A at the end of the first listening period; it advances in one hour 10 knots to C' on the edge of the listening circle drawn drom A'. At the end of the third listening period it will be at C''. At this time the first scout will be at A'', well out of listening range of the enemy vessel. In order to prevent the enemy vessel from passing through undetected the second scout must be at the end of its third listening period within 15 miles of C'', or at B'', the intersection of an arc drawn from C'', with a radius of 15 miles, with the line AB. If the second scout must be at B'' during the third listening period, it must be at B' during the second period and at B during the first period. AB, the scouting distance, is 43 miles.

The following table shows the scouting distances for various speeds of the enemy and various average and running speeds of the scouts:

TABLE 4

Assumed speed of enemy	Average speed of scouts	Running speed	Scouting distance
10	15	20	43
10	18	24	46
10	21	28	49
12	15	20	42
12	18	24	44
12	21	28	46.5
14	15	20	37
14	18	24	39.5
14	21	28	41

In Fig. 8 there is shown an example of search by the Retiring Search Patrol Method. At 6 p. m. an enemy force was reported at O. Assuming a maximum speed of ten knots for the enemy

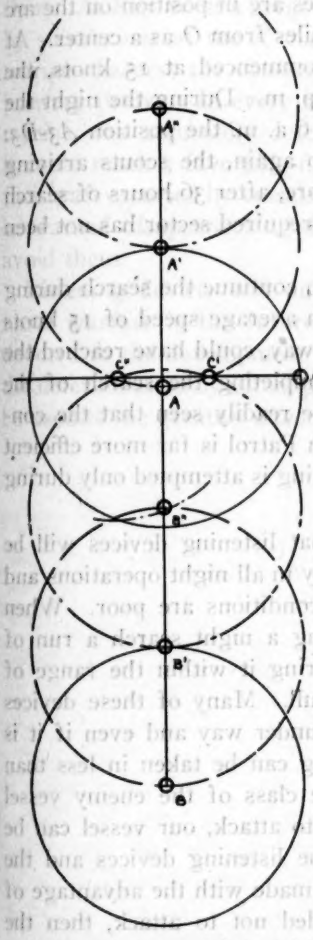

FIG. 7.—Patrol Method.

Average Speed of Scouts = 15.
Running Speed of Scouts = 20.
Scouting Distance = 43.

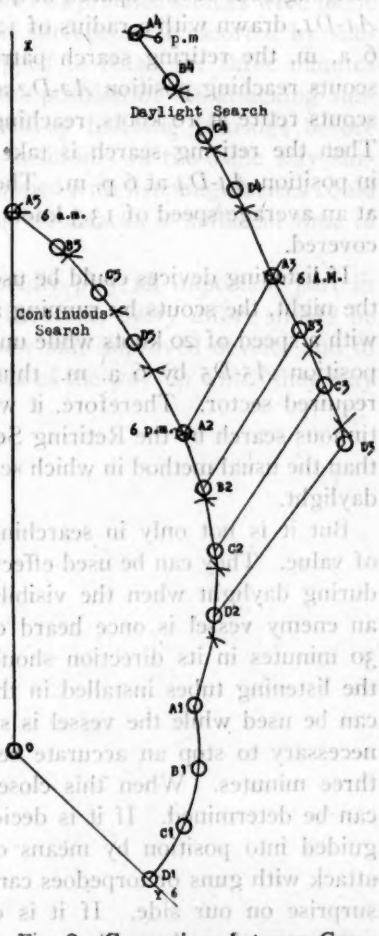

FIG. 8.—Comparison between Continuous Search and Daylight Search with the Retiring Search Patrol.

Scouting Distance = 40.
Average Speed for Continuous Search = 15.
Average Speed for Daylight Search = 13.3.

it is required to search the sector *XOY*. At 6 a. m. the next morning four scouts spaced at 40 miles are in position on the arc *A1-D1*, drawn with a radius of 120 miles from *O* as a center. At 6 a. m. the retiring search patrol commenced at 15 knots, the scouts reaching position *A2-D2* at 6 p. m. During the night the scouts retire at 10 knots, reaching at 6 a. m. the position *A3-D3*. Then the retiring search is taken up again, the scouts arriving in position *A4-D4* at 6 p. m. Therefore, after 36 hours of search at an average speed of 13.3 knots the required sector has not been covered.

If listening devices could be used to continue the search during the night, the scouts by running at an average speed of 15 knots with a speed of 20 knots while under way, could have reached the position *A5-D5* by 6 a. m., thus completing the search of the required sector. Therefore, it will be readily seen that the continuous search by the Retiring Search Patrol is far more efficient than the usual method in which searching is attempted only during daylight.

But it is not only in searching that listening devices will be of value. They can be used effectively in all night operations and during daylight when the visibility conditions are poor. When an enemy vessel is once heard during a night search a run of 30 minutes in its direction should bring it within the range of the listening tubes installed in the hull. Many of these devices can be used while the vessel is still under way and even if it is necessary to stop an accurate bearing can be taken in less than three minutes. When this close the class of the enemy vessel can be determined. If it is decided to attack, our vessel can be guided into position by means of the listening devices and the attack with guns or torpedoes can be made with the advantage of surprise on our side. If it is decided not to attack, then the enemy vessel can be easily avoided and its position can be reported so that, if considered desirable, superior forces can be concentrated upon it. In this way enemy forces can be reconnoitered during the night and their positions can be reported without ever getting within sighting distance. This will allow destroyers making a night torpedo attack to be guided to their targets and will facilitate the surprise of enemy surface craft by superior forces at daylight.

Listening devices will also be of great value in screening operations. At Key West a great number of practice attacks were made by submarines of the *K* class on surface craft escorted by submarine chasers; the chasers stopped to listen for three minutes in every twelve. In every case the position of the attacking submarine was accurately determined by listening bearings before it could reach a favorable firing position. In the same way surface craft escorted by vessels equipped with listening devices could be warned of approaching destroyers attacks in sufficient time to avoid them.

Listening devices will undoubtedly play an important part in naval warfare in the future. Therefore, every effort should be devoted to the development of new and improved devices and to the determination by actual practice of the ways in which they may be used to the greatest effect.

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THE CONSTRUCTION AND REPAIR DEPARTMENT AFLOAT, RECORDS OF WORK AND THE HULL BOOK

By LIEUTENANT R. R. CLARKE (C. C.), U. S. Navy

The desirability of maintaining a record of the more important work undertaken by the mechanics of the deck force on one of the armored cruisers of the Pacific fleet led to experimental work along the lines described below during the years of 1916 and 1917. While the record has doubtless since been discontinued due to the inevitable changes in officer personnel and to the fact that regulations do not require keeping such records, the desirability of such a record aboard ship is so evident that the following description of the system is given as a means of directing attention to an important matter deserving of more consideration than it receives aboard the average naval vessel.

A record of work of this, or a similar nature, will obviously be of no practical value when carried over a period of several years, unless the information is carefully tabulated and filed so that data desired can be readily located with a minimum expenditure of time, and it well may be that the failure to keep such records heretofore is partly caused by a realization of the hopelessness of finding desired information in the usual form of record. Incidental to the record of work it is also desirable to systematize the work of the mechanics engaged, so that their time may be employed on productive work to the greatest possible extent, both through using the proper man on each job, and through having material available at the proper time. Such results can be more readily obtained when a considerable list of work is always available for allotment to the individual mechanics, paying due consideration to the varying degree of skill and the general dependability of each.

It is unnecessary and undesirable to record in a permanent file the majority of the work undertaken, since much of it has no particular interest or value after being completed. Some form of recording all current work is desirable, however, and the "Work

Books" used on many ships answer this purpose in an admirable manner. Loose individual job orders on a cruising vessel are open to many objections, not the least of which is the facility with which they may be mislaid or lost if sent to the shops. On the ship in question two work books were maintained, one for the carpenter's shop and one for the paint shop, in which all items of work were entered as their necessity became manifest. Items of work were entered in these books without particular reference to their urgency but with the date when entered preceding each item and a statement of the urgency of the item following, such as "urgent," "immediate," "when convenient," "prior to next coaling," etc. All items of work were entered on the left-hand pages of the open book leaving the right-hand pages blank for entries as to date of commencing work, date of completion, material used, and the name of the mechanic who performed the work. In general a list of material used was not required, but if a list was desired notation was made to this effect in entering the item of work. During working hours the books were in their respective shops but were returned to the chief carpenter's stateroom about 4.30 p. m. each day and were accompanied by any requests for material desired in connection with the work to be undertaken the following day. The work books remained in the chief carpenter's room overnight and went to the shops before working hours with any additional items of work entered and with signed chits for the material which had been requested. The items of work to be entered in the work books were derived from various sources, numerous items being received from the first lieutenant's office in the form of memo lists of items reported in the weekly hull inspections, items noted on special inspections, etc. Items of work involving the use of a considerable amount of material were covered by regular job orders on S. & A. Form No. 316 under Titles "D," "K," or "P" as appropriate, but such job orders when received were entered in the work books the same as other items and the job order retained by the chief carpenter until it could be reported completed. The majority of expenditures under these titles were made against regular standing job orders issued each quarter and each covering certain specific work, such as,

D-27. Charge to this number the cost of all material used in repairs to linoleum during the second quarter of 1916.

P-30. Charge to this number the cost of all material used in repairs to boats during the second quarter of 1916.

so that the only use made of the ordinary standing job order was in connection with the charging of material drawn out of store, to the appropriate job order number.

The chief carpenter's mate and the head painter were each responsible for distribution of work in their respective shops and for having the proper entries made on the right hand pages of the work books as jobs were undertaken and completed, however many of the entries were made by the men actually doing the work, after they became familiar with the requirements of the system. Especial effort was made to have these work books of interest and help to the mechanics by giving all possible information relative to special drills scheduled for the day, commending any work exceptionally well done, pasting in clippings or copying data relative to tap drill sizes, machine and wood screw sizes, pipe threads, etc., or any other items of interest that might facilitate their work. It was found to be very convenient to leave a number of pages blank in commencing a new book so that standing orders, special details, general instructions, etc., could be entered therein from time to time as occasion arose. Various sizes of work books were used, a book about 8″ x 10½″ with 150 to 200 pages is convenient, but in general too large a book is objectionable as it is subject to hard wear and should not fall apart before it has been filled.

The successful accomplishment of work requires co-operation between all concerned and an iron clad adherence to any system worthy of adoption is likely to meet with disaster unless discretion is used, especially is this true in any endeavor to establish definite times for the obtaining of material. The obtaining of material in advance is usually a matter of growth with even the best mechanics and is never fully acquired by some. It is of greatest importance therefore that chits for material should always be forthcoming at any time, encouraging the requesting of material at stated times but not insisting upon it. A mechanic should not be given the slightest excuse for feeling it might be better to loaf for an hour or two in order that an irregular request for material need not be made, as the officer who shows a disposition to hold his men to so-called " efficiency methods " for his own convenience is soon correctly tabulated by them and imitated in ways not calculated to increase efficiency. Likewise it is desirable that when occasions arise, as they frequently do aboard ship, which require

that certain work be undertaken at once instead of in the routine way, the inconvenience of making a special trip to the shop for the purpose of writing the necessary order in the work book is well worth while in the effect it has toward establishing system.

As the work books described above contain all items of work undertaken by the mechanics and painters of the Construction and Repair Department of the ship with the dates of commencing and completing each item, the selection of those items which are to be permanently recorded is a simple matter and the actual recording can be undertaken at intervals as may be found most convenient. The permanent record in the case under consideration was contained in a card file of standard 5″ x 8″ cards with the necessary guides to insure ready access to any compartment or other subdivision of the file. This size of card was adopted on account of its being a convenient size for use in a typewriter, the desirability of having the permanent record typewritten being self-evident. The guide cards used were ⅓ cut and some of the actual guide card headings are listed as follows to suggest the arrangement of the file:

"A" compartments, 1 to 99.
"A" compartments, 100 and up.
"B" compartments, 1 to 99.
"B" compartments, 100 and up.
"C" compartments, 1 to 99.
"C" compartments, 100 and up.
"D" compartments, 1 to 99.
"D" compartments, 100 and up.
Stateroom records.
Auxiliary C. & R. machinery.
Drain valve record.
Ventilation systems.
Watertight doors and hatches.
Plumbing.
Fire main.
Flushing main.
Air and gunports.
Gun deck.
Main deck.
Bridges.
Boats.
Data for requisitions.
Sketches.
Drydockings and draft records.
Ship's force job orders.
(Titles "D," "K," and "P.")
Navy yard repair memo.
Unfinished navy yard work.
Alterations by ship's force.
Repair division data.
Miscellaneous.

Although not strictly required as a part of the record, descriptive cards were prepared in conjunction with the various subdivisions of the record, one of these cards was prepared for each water-tight compartment similar to that illustrated for compartment A-3 by Card No. 1. These descriptive cards were standard weight cards 5″ x 8″ but the record cards were of lighter stock cut from heavy durable paper and used on account of the greater

facility with which they could be inserted in a typewriter. The data on the descriptive cards was compiled with a view to its probable utility, in the case of "Boats" it contained the type, length, date and condition when received, hull number, engine number, etc., in the case of staterooms a list of the furniture and other equipment was given for each, and under the other headings such data were given as experience indicated would be of frequent value.

A-3. DRY PROVISIONS DESCRIPTIVE CARD U. S. S. .....

Hold compartment between frames 11-16 on the starboard side from outer plating to upper platform deck. Entrance is through a water-tight hatch in the upper platform deck at the bottom of A-23 (Access Trunk). Compartment A-4 corresponds on the port side of the ship.

Compartment is drained through the secondary drain. The valve is in the after inboard corner of the compartment, is a 3-inch stop, check, and can be operated on the berth deck between frames 15-16 on the starboard side near the centerline.

Sounding tube socket for the compartment is on the berth deck between frames 13-14 on the starboard side near the centerline.

It is ventilated from Supply Blower No. 3. in the C. P. O. quarters. An automatic ball float valve protects the outlet in A-3 and a butterfly valve at the upper platform deck can be operated from the bottom of A-23. An 8-inch butterfly valve just above the protective deck can be operated on the berth deck between frames 14-15 on the starboard side near the centerline, this valve also cuts off ventilation from A-22 just above A-3. The supply pipe for A-3 is 4½ inches in diameter where it enters the compartment.

Painted area in the bilge below the floor boards is about 400 square feet and is painted with red lead paint. Painted area above the floor boards is about 980 square feet and is painted with inside white paint over red lead.

CARD NO. 1. (Standard weight.)

Card No. 2 illustrates record data for compartment A-3 and in the actual file followed next after Card No. 1, being for the same compartment. After filling the first record card a new one with the same heading marked (continued) would be commenced for the same compartment, making a continuous record for that compartment all filed together and readily accessible at any time without a necessity for extended search to locate information desired. It is of course important that only such data be recorded as might be expected to be of future interest, otherwise a bulky file results with attendant difficulty and loss of time in locating

data. Duplication should be avoided as far as practicable but is necessary to a certain extent, as for instance, in alterations which must necessarily be recorded in some cases briefly under the compartment record as well as under the heading "alterations." A chronological record of alterations is very desirable on board ship and probably no other part of the record is of more real utility or interest or should be more carefully maintained, it should cover both alterations made by the ship's force and by repair ships or shore establishments, in order that a complete list of all important alterations may be available, but alterations accomplished by different forces can be carried on separate cards if considered desirable.

A-3. DRY PROVISIONS RECORD CARD U. S. S.....

1/28/17. All stores broken out and entire compartment cleaned out and repainted. Work done by 1st Division—Completed 2/12/17.

7/19/17. Compartment was critically examined, ventilation pipes blank flanged, conduit junction boxes, etc., were overhauled and an air pressure was applied. Preliminary test indicated necessity of calking the hatch bounding angle. After calking, an air pressure of 5 pounds per square inch was applied. This pressure dropped to 3 pounds in 20 minutes after air was shut off. Compartment considered in satisfactory water-tight condition.

8/25/17. Captain of the hold allowed fresh water tanks in the compartment above to overflow. About 2000 gallons of this water was drained into the bilges of A-3 and pumped from there into reserve feed bottoms.

10/16/17. All stores were broken out, bilges cleaned, rust streaks scraped, and the paint work touched up. Work was done by the 1st Division—Completed 10/24/17.

CARD NO. 2. (Light weight.)

Certain work aboard ship requires periodical repetition and work of this character can be typified by periodical overhauling of drain valves. It is desirable that each drain valve should be opened up for inspection twice a year but this schedule cannot be maintained with absolute regularity owing to the necessity of having stores or other gear broken out of some compartments in order that the valves may be accessible. The list of drain valves on the ship in question was not too lengthy to preclude its incorporation on two cards, one for the forward drain valves under cognizance of the first lieutenant and one for the after drain valves under his cognizance (all the midship valves being under the cognizance of the engineer officer). These two cards merely con-

tained a list of the valves in a column on the left side of the cards, the remainder of the space being used for pencil notation opposite each valve of the dates of overhaul, the purpose being to facilitate arranging schedules for drain valve overhauls. Card No. 3 illustrates the data relative to drain valve overhauls for compartment A-3 and in the actual file was placed in its proper numerical order after the guide headed "drain valve record" preceded by the drain valve cards for compartment A-1 and A-2 and followed by the cards for such "A" & "D" compartments as were provided with drainage arrangements. It will be noted that on this

DRAIN VALVE RECORD COMPARTMENT A-3 U. S. S.....

Valve is a 3-inch stop, check, on the secondary drain line. It is located in the after inboard corner of the compartment and can be operated on the berth deck between frames 15-16 on the starboard side near the centerline.

OVERHAUL RECORD

7/18/16. Overhauled by Bent, A. D. In bad condition, partly filled with trash, required grinding in and general cleaning and oiling.

12/14/16. Disassembled and examined by Godfrey, O. R., prior to refilling compartment with stores. In good condition, no work required except oiling.

8/26/17. Overhauled by Bent, A. D., after removal of fresh water from bilges of the compartment, valve was cleaned, dried, and oiled.

10/31/17. * * * Valve could not be operated on weekly test and it was found the wood casing for valve operating gear had been slightly broken while stowing compartment so that the bevel gears were jammed. Casing was repaired and valve then tested out O. K. Work done by Bent, A. D., and Smith, L. A.

CARD NO. 3. (Light weight.)

card the descriptive data does not require all the space and that the record data is commenced on the same card to utilize space to the best advantage.

The brief description given of this file and the cards shown will suffice to give an idea of the practicability of the file but only actual experience in the keeping of data in such form can prove the usefulness of the system and the frequency with which information is derived from it after the commanding and other officers discover that accurate information is available on short notice. Some of the most useful sections of the file are those containing sketches of makeshift target rafts, splash targets, towing spars, special fittings frequently required on requisitions; data for requi-

sitions such as, sizes, type, length and quantities of machine screws for the various hatches or doors on the vessel, the quantity of paint required to paint the ship outboard, or lists of the sizes of gasket rubber required for all purposes on the vessel, since such information allows making prompt estimates of stock required for any extensive work. Few officers engaged in C. & R. work aboard ship care to spend the time necessary to inaugurate a satisfactory filing system covering their work because of the practical certainty that successors will scrap the system and start another one, or more likely fail to keep any at all. If however, a system were devised sufficiently flexible to suit the varying requirements of at least the more important ships and maintenance of the system made obligatory, its continued upkeep should be practicable and profitable both in connection with the maintenance of the vessel and as a means of education to the personnel concerned. Although in the case under consideration the file was not an adjunct of the first lieutenant's office, such a file if kept, should be in his office and could be largely maintained by his yeoman if all officers concerned were required to report in writing any data to be filed therein. Such data should of course be scrutinized by the first lieutenant before being typewritten on the cards, to make certain of its being in proper form and desirable for addition to the file.

An excellent system had been in operation on this vessel for a number of years in connection with maintenance of the hull book and, since this record is more or less allied with the record of C. & R. work, it will be briefly described. The book consisted of a binder for loose forms printed on cap size paper leaving wide margins at the tops, as they were secured in the binder by their tops. All reports were required to be in the first lieutenant's office by Monday morning of each week, they were inserted in the binder after the first lieutenant had looked them over and filled out his form emphasizing any items of special interest and adding any items of his own. The book was forwarded to the executive officer by Tuesday morning for his perusal and he forwarded the book to the commanding officer not later than Thursday morning. The commanding officer's inspection was regularly held on Friday afternoon of each week and the above schedule allowed the commanding officer to look through the hull book prior to making his inspection and thus have advance information rela-

tive to the work considered of prime importance by the heads of departments, division officers, etc., after completing his inspection he could again refer to the hull book and note if officers had overlooked reporting conditions which he had noted during his inspection. On Monday morning the hull book was returned to the first lieutenant's office to commence another round. The older reports were removed from the hull book from time to time to prevent the book from becoming inconveniently bulky but a number of the later reports were retained in the book at such times to allow of comparison with new reports, if desired.

The following named officers were required to submit reports in the hull book each week and each reporting officer had his own special form to fill out:

1st lieutenant.	Medical officer.	1st division officer.
Engineer officer.	Supply officer.	2d division officer.
Gunnery officer.	Chief carpenter.	3d division officer.
Navigator.	Chief electrician.	4th division officer.

Each form was printed on cap size paper and punched on the top end for insertion in the hull book. The forms differed slightly in wording but in general were much alike, the list of compartments in each case being arranged in tabular form down the left margin of the form leaving all the space to the right of the column for notes as to condition or items of work required. The form for the 1st division officer is illustrated in Fig. 1, but to save space only a few of the compartment numbers are entered.

U. S. S. 191-

I have completed the weekly inspection of all compartments, watertight doors, and mechanical devices for the safety and management of this vessel which come under the cognizance of the 1st Division Officer and find the condition of same to be as follows:

A-1
A-2
A-21
Etc.

.....
1st Division Officer.

FIG. 1.

The supply officer, being in charge of store rooms, issuing rooms, etc., reported on all such compartments as were under his cognizance; and the medical officer reported on compartments in

which medical stores were kept, the sick bay, operating room and kindred compartments, as well as on the sanitary condition of all living compartments, cold storage compartments, galleys, pantries, laundry, etc. The forms for the first lieutenant, chief electrician, and chief carpenter did not contain lists of compartments and the forms for these reports are illustrated by Fig. 2, 3, and 4, respectively. In the case of the chief carpenter a typical report is shown to show how items previously reported as requiring work were reported completed. Uncompleted items were reported on each successive report until they could be reported as completed and items of work beyond the capacity of the ship's force were followed by the statement that they were beyond the capacity of the ship's force, had been added to the list of work to be requested at the next visit to a navy yard, and would not be reported on subsequent hull reports.

U. S. S. ..... 191-.

I have had the weekly inspection of all compartments, water-tight doors, hatches, air ports, and all mechanical devices for the safety and management of this ship under the cognizance of the first lieutenant made and defects are as reported by Division and other officers reports herewith.

.....

First Lieutenant.

FIG. 2.

U. S. S. ..... 191-.

I have completed the weekly inspection of all electric light systems, call bell systems, fire alarms, battery control systems, long arm system, and operation systems and find the condition of same to be as follows:

.....

Chief Electrician.

FIG. 3.

There are a number of advantages in keeping a hull book by this system but perhaps two of the most important ones are that the reports are put to actual use in the ship's routine of work and inspections, which tends to promote making the reports more than a mere form to barely comply with the regulations, without the added incentive that the reports are scrutinized each week by three of the vessel's ranking officers; also that the reporting is systematically divided up between a number of officers each of whom is reporting on matters directly under his cognizance so that rela-

tively complete reports can be obtained without undue burden on a few officers. Too much emphasis cannot be laid on the desirability of having reports made aboard ship in a shipshape manner as a means of training of the personnel.

U. S. S. *Speed*, May 19, 1917.

I have completed the weekly inspection of all compartments, watertight doors, hatches, air ports, and mechanical devices for the safety and management of this ship coming under the cognizance of the chief carpenter and find the condition of same to be as follows:

All in apparent good condition except as noted below.

1. Operating gear for the armored hatch in the protective deck to A-23 has carried away and new shaft and pedestal casting are required. This item has been covered by a letter requesting new parts on our arrival at Balboa. Hatch is secured in open position, but can be closed, if necessary, by using chain falls.

2. Starboard whaleboat is leaky and requires recalking. This work is being deferred pending arrival in port to allow getting boat in a convenient location for the work.

3. After fresh water tanks require cleaning out and cement washing. This work has been completed in connection with all forward tanks.

4. Air ports in staterooms Nos. 17, 19, 20, and in isolation ward are leaking slightly. Gaskets will be renewed on arrival in port.

5. The 45-fathom shot of chain on port anchor is badly chafed and strained in connection with recent salvage operations and cannot be considered reliable. It should be shifted and replaced by the similar shot in the port sheet locker, for which no anchor is provided.

6. Compartment A-20 is continually wet through excessive sweating of the compartment. Sweating is due to fact that steam line to ice machine parallels closely the fire main. No remedy appears practicable at present time, but sweating is reduced somewhat if compartment is kept closed up.

7. An armor bolt in cofferdam A-100 allows slight leakage from outboard. A new grommet will be installed after arrival in port and this will probably stop the leakage.

8. Linoleum amidships on the gun deck is in poor condition and repairs are being made as rapidly as more urgent work permits.

9. Staterooms 23, 25, and 30 require repainting and furniture should be revarnished. Rooms are occupied at present and this work cannot be undertaken.

10. Fire hose for fire plugs Nos. 3, 34, 41, 42, and 47 is worn out and requires renewal. New hose is available at Balboa and necessary replacement will be accomplished prior to departure from that port.

All work necessary in connection with items Nos. 3, 4, 6, 8, and 10 in my report for the previous week has been completed.

H. R. SWIFT,
Chief Carpenter, U. S. N.

FIG. 4.

timely complete reports can be obtained without undue burden on a few officers. Too much emphasis cannot be laid on the desirability of having reports made aboard ship in a shipshape manner as a means of training of the personnel.

U. S. S. *Nyad*, May 19, 1917.

1. Have completed the weekly inspection of all compartments, water tight doors, hatches, air ports, and mechanical devices for the safety and management of this ship during under the cognizance of the chief carpenter and find the condition of same to be as follows:

All in apparent good condition except as noted below.

(a) Caisson gear for the armored hatch in the protective deck to A-23 has carried away and new shaft and pedestal casting are required. This item has been covered by a letter requesting new parts on our arrival at Halifax. Hatch is secured in open position, but can be closed, if necessary, by using chain falls.

2. Starboard whaleboat is leaky and requires recaulking. This work is being deferred pending arrival in port to allow getting boat in a convenient location for the work.

3. After fresh water tanks require cleaning out and coating washing. This work has been completed in connection with all forward tanks.

4. Air ports in staterooms Nos. 17, 19, 20, and in isolation ward are leaking slightly. Gaskets will be renewed on arrival in port.

5. The 45-fathom shot of chain on port anchor is badly chafed and stranded in connection with recent salvage operations and cannot be considered reliable. It should be shifted and replaced by the similar shot in the port chain locker, for which no anchor is provided.

6. Compartment A-20 is continually wet through excessive sweating of the compartment. Sweating is due to fact that steam line to ice machine parallels closely the fire main. No remedy appears practicable at present time, but sweating is reduced somewhat if compartment is kept closed up.

7. Armored belt in outboard A-100 allows slight leakage from outboard. A new gromnet will be installed after arrival in port and this will probably stop the leakage.

8. Linoleum amidships on the gun deck is in poor condition and repairs are being made as rapidly as more urgent work permits.

9. Staterooms 23, 25, and 30 require repainting and furniture should be re-varnished. Rooms are occupied at present and this work cannot be undertaken.

10. Fire hose for fire plugs Nos. 34, 44, 45, and 47 is worn out and requires renewal. New hose is available at Halifax and necessary replacement will be accomplished prior to departure from that port.

All work necessary in connection with items Nos. 1, 6, 8, and 10 in my report for the previous week has been completed.

R. SWAIN,
Chief Carpenter, U. S. N.

The

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PIPE SWEEPERS

By COMMANDER C. N. HINKAMP, U. S. Navy

Few people except those present when they sailed know much about the minesweepers that left these shores for the mine fields of France. Owing to the activities of the censor, no information was made public concerning the outfitting of the United States mine sweepers that operated off the French Coast during the war. How many ever heard of "Squadron Four, Patrol Force" which swept enemy mines off the French ports when the submarine menace was at its height? And how many know anything about the mine sweepers of the Allies before we entered the war? Few. Few outside of those who had to travel the channels and areas mined and then not until these areas had been swept or cleared of the danger. The knowledge of clear channels is a much needed one when troops are being transported, and were it not for skillful sweeping, many more soldiers and sailors would be among the missing. Hence the sweepers and this story.

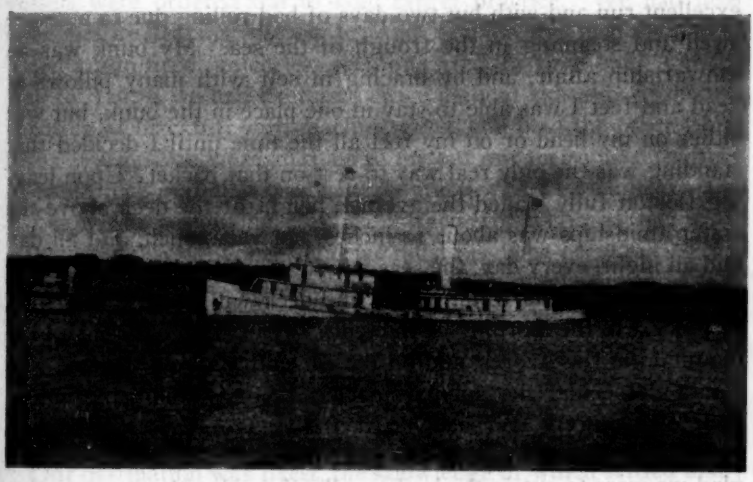
Let us go back to August, 1917, four and a half months after the declaration of war with Germany. One by one the converted wooden fishing steamers commonly called "porgie boats," familiar to all coastwise sailormen, came into Boston from various navy yards along the coast, to get their orders and make final preparations for sea. "Where do we go from here?" was heard on all sides. The fishing steamers were about 160 feet in length, 25 feet beam, draft 14 to 15 feet, displacement about 400 tons, speed 9 knots, and capable of carrying close to one million fish with a full hold and decks piled high. The rebuilding consisted of enlarging the deck house to accommodate more men, moving the pilot house to the rear about ten feet to make room for a gun forward, fitting part of the fish hold as a magazine and store room, and mounting two guns, one forward and one aft. Additional coal was carried in the remaining space in the fish hold, and enough ballast was added to compensate for the high location of the guns. Ordinary life boats, life preservers and a life raft com-

pleted the conversion from a fish boat to a man-o-war. A complete radio outfit and a typewriter were added to increase efficiency, as well as a machine gun and a depth charge.

It was my luck to miss the rebuilding period these boats went through, the assembling of the crews and other drudgery in connection with the organization. My telegraphic orders brought me to the scene twenty hours before the time set to sail so I had little to do but say goodbye, coal ship, take on life rafts and water, inspect the ship, learn her needs of which there were many, get acquainted with the officers, investigate the grub situation, report to my senior in command of the squadron, inspect the guns, and get my orders. I might add that in this period I found leisure enough to unpack my bags, get my cabin in order, and make out endless reports which some one wanted before sailing. All red tape was not cut even during the war, but thank heaven we cut enough to get away on time. I hope there will be no reckoning for eighty years. We were informed that on the next day, Saturday the 25th of August, our entire convoy of ten sweepers, six submarine chasers, one collier and one yacht (the flagship) would rendezvous at Provincetown, Massachusetts, and sail from there some time Sunday, hour unknown, weather uncertain, destination a secret. By noon Sunday all but one sweeper of the convoy were there, and we were told to be ready at 4 p. m. We were a motley assortment of ships, camouflaged according to the wildest fancies of three schools, all the colors of the rainbow, all the effects which delirium tremens could envy but not duplicate. And on the docks watching this scene were the fisherfolk of Provincetown, a few of the wives of those about to sail, and the local patrol crews. Captain Y—— of the *Bessie Q.*, who had sailed on the fishing banks for many a season remarked that he'd never take a steam fish boat across the ocean, and that it was suicide to attempt it. This and others like it were the cheering sentences heard on all sides, and such were the delightful impressions left in the minds of those who had to remain behind.

It was a bright day, clear and reasonably warm, wind from the Northwest, barometer "high and rising" and good weather was predicted for several days. Promptly at four o'clock we heaved in our anchors, by hand and it was some job, housed them for a long trip, and headed out of the harbor for the open sea. The straggling sweeper joined us, so our convoy was complete, and in a short time we got into a semblance of the prescribed

formation, and by nightfall we had left the good old U. S. A. on the western side of the horizon. The collier, the *Bath* by name, formerly a German merchantman, and the *Wakiva*, the yacht led the parade, the sweepers formed in line of divisions, and the six sub-chasers filled in odd gaps in columns of three. It was a sight to strike terror to any submarine, one fisherman allowed it was not the submarines he feared, it was the sea, for had a submarine seen all of us an attack was unlikely, while if a real sea hit us we would have sunk without a trace. Later developments showed he was correct.



U. S. S. "McNEAL" MINE SWEEPER.

Our departure from Provincetown, the landing place of the Pilgrims, was a success; that is, we got in and out and no one knew where we were going. About ten miles out we opened our orders and learned that Ponta del Gada in the Azores was to be our first stop, 2200 miles away, and no intermediate station to rest in. The submarine chasers had fuel to cruise about 700 miles only, so they had to be towed most of the way, six of the sweepers being detailed for this duty. This phase of the trip is a separate story in itself with the breakdowns of engines, parting of towlines, and other incidental mishaps. One evening at dusk, about 1500 miles out one of the chasers which had parted her towline came alongside and asked for a tow. We said "sure if you will go to the supply ship *Bath* and get us two hams and a bag of flour."

We never dreamed it would be done, but about three hours later in the inky darkness mister chaser came alongside, threw two hams and a bag of flour on board and at the same time heaved us his towline. He had earned his tow, so we took the line, made fast, and had a fine time towing this bird the rest of the way. This is but one of the many incidents of the voyage.

The weather was excellent, had it not been, another tale would be told, for the cruise was a long one and coal capacity limited. The sweepers had their share of troubles, hot bearings, salty boilers, lack of food, lack of proper cooking utensils, and other omissions due to a hasty getaway. The trip took eleven days, an excellent run and with but two days of bad rolling due to a severe swell and steaming in the trough of the sea. My bunk was an athwartship affair, and by bracing myself with many pillows at head and feet I was able to stay in one place in the bunk, but was either on my head or on my feet all the time until I decided that standing was the only real way to rest on that packet Upon leaving Boston fully loaded the average height of the deck above the water amidships was about 12 inches, not very much, and all day and all night, every day, the seas swept across the well deck. The swish swash of the water across the deck will always be a fond memory. In the morning of the tenth day we sighted Pico, a high mountain in the Azores, and on the eleventh day we steamed into Ponta del Gada, the submarine chasers gaily following under their own power. We had heard of the Azores, few of us had seen them, and rocky as it was, that land looked good to us, and glad we were to get in the harbor, all safe and without any major casualties to mar the voyage.

It is customary in most foreign ports to take a pilot on board to guide the ship safely to proper anchorage, but in the case of a squadron or fleet of men-o-war one pilot on the flagship is considered enough. The pilots association of the Azores must have a powerful organization politically, for no matter how much we refused to stop to take them on board, the more they persisted in getting aboard. We saw the flagship had taken a pilot, no more seemed necessary, but no, each vessel must have a pilot. The one that got aboard my ship finally got a good wetting which didn't improve his disposition. Pilots as a race are a jealous lot, but professionally able men. It was a comfort on mooring to see five coal burning destroyers and their repair ship already there. The *Panther* was a blessing, for with her aid we made all

the minor repairs necessary to continue the voyage. The harbor was full of all kinds of craft, and the inevitable bumboat with its load of fresh fruits and pastry. We ate the fresh fruits, the pastries were too heavy and unlike anything that mother used to make.

During our stay of six days we filled with coal and fresh water, took on food, made minor machinery repairs, and permitted the officers and men to go ashore for relaxation. They did. Several signs indicating the sale of local beverages had a delightful effect, immediately the world in general and the mountain scenery in particular took on a new aspect. One bright morning all the vessels were ordered out to hold target practice. We had held none before leaving the States and few of the men had ever heard a gun fired, much less seen one fired, or fired one. On the way to Azores we had exercised twice daily at subcaliber practice, shooting at blackfish with machine guns, and held the other usual drills at sea. We were anxious to try out our magnificent battery of two 3-inch guns. It was a funny practice as we look back upon it, but it was serious business to us then, for we knew not when a submarine would appear and we must needs be prepared. Each vessel fired at a home made target towed by another vessel. The shooting was creditable. The officers at the guns tried hard, so did the men. All hands learned a lot. While we were out shooting the flagship called all vessels within hail, delivered each a set of orders, and without a chance to say goodbye to the Azores, we left their refuge for France.

Our destination was Brest, the knowledge of which settled many an argument for we had visions of Gibraltar, Marsailles, Bordeaux, and even Queenstown. This leg of the trip was about 1200 miles, it took seven days, we met stormy weather for two days cutting our speed materially, and also making several sea sick, even those who were generally immune. In a fog all ships got separated more or less and we missed the *Bath* and one sweeper. The sweeper appeared in a haze the morning we arrived off Brest, but the *Bath* did not show up until much later. For a wandering child she took the prize, running alone in a dangerous area, over mine fields and near rocks, and finally was escorted in by a patrol vessel sent specially to look for her. The crews of the chasers being French felt that they were arriving home and believe me they cruised around joyously, maneuvering all over the place, showing off and getting in the way. You

have all read about Brest, wet, damp, and generally rotten weather. Whatever bad is said about Brest weather comes nearly being true, for it rains about 330 days of the year, it has plenty of fog, and the streets are always muddy. Well, here we were after 3400 miles of cruising, the U. S. Naval Headquarters in France, with plenty to do and all ready to begin. The admiral decided to give us a brief rest for a few days which we appreciated.

Mining activities by the Germans at this time, September, 1917, had subsided to a routine planting in regular channels, and the French found it no trick to get all that they had planted. So it was decided to place sweepers on escort duty with the yachts and other small vessels based on Brest. Escort duty consisted in accompanying merchant convoys on their trips down and up the coast, keeping them in safe waters and protecting them against possible submarine attack. The route of the convoys was particularly subject to submarine attack, and many a good ship found the bottom near the French Coast in spite of the care and protection of the escort, but many more ships would have been sunk were it not for them. The sweepers took to this duty with enthusiasm, but it was short lived, the first schedule was attempted and almost accomplished when the news of the sinking of the *Rehoboth*, one of the sweepers, put a crimp in the idea that these boats were seagoing. There was a good blow on, and these blows being of frequent occurrence in these waters at this time of the year it was decided to take the sweepers off this duty and install the French mine sweeping gear. In November the mine-laying activities of the enemy were revived, and work on the sweepers was rushed. During the progress of this work several officers and men were detailed to go out with the French sweepers to learn their methods in handling the system of sweep or drag. By December some of the vessels were ready, we left Brest and established our base at Lorient from which we carried on all operations. By January all the sweepers were finished and joining the forces at Lorient. The French method of sweeping possessed features of great advantage over any other system for these waters. The sweep or drag was called the "single ship" drag; that is, there was but one ship on each drag and each vessel could act independently. In other forms of sweeping there was generally two vessels acting together in pairs. By an ingenious arrangement of kites, similar to paravanes used by larger ships, a large "V" or wedge of wire cable was dragged through the water

at any predetermined depth. On the arms of this wedge were placed several explosive knives which, when the mine cable was engaged, exploded, cutting the mine anchor cable, whereupon the mine floated to the surface of the water. It could then be fired upon, blowing it up, or sinking it. Each sweeper could drag a path 200 yards wide, so that five ships could clean a channel ½ mile wide with ease. With an arrangement of floats and pendants to the kites the depth at which the dragging was done could be regulated to a nicety. In any given area the soundings would govern the depth of sweeping. In order to conserve the ships engaged in the operations, and to take advantage of all factors of safety (of which there were few) most of the sweeping was done on the high tide. The tides on the coast of France cover a wide range, in some parts being as much as 33 feet. Where we swept, between Penmarc'h Point and St. Nazaire, they had a range of about 14 feet. The draft of our vessels having been reduced to 12½ feet by the removal of much gear and a gun, allowed a range of about 6 feet during which sweeping could be carried on with a reasonable assurance of not hitting an anchored mine, as they were set to remain about three feet below the surface at low water. This meant that sweeping could be carried on during about five hours a day, during daylight. In the summer months when the sun rises early, and never seems to set, we could sweep on the morning and evening tides, but this was seldom done, and only when a troop convoy was expected. Our principal work was the exploration sweeping along the coastal convoy routes. In this sweeping no regard was paid to the state of the tides, as the convoys traveled at all hours of the day or night, and the channels had to be cleared for them. These routes were explored every other day, and the troops convoy routes to St. Nazaire were swept just before the arrival of the transports.

The ten sweepers that went over in August, 1917, were *McNeal, Cahill, Anderton, Hinton, Rehoboth, Lewis, Bauman, Courtney, Douglas, James.* Two others were supposed to join the party, the *Edwards* and the *Hubbard.* The *Hubbard* finally got over later on in the year, but the *Edwards* had to return after making a start, as she almost foundered in a storm off Halifax. Of the eleven sweepers that got over there are six left and they are still in France, unable to get home. The first one to be lost was the *Rehoboth,* in a blow off Ushant while on escort duty. The next one was the *Bauman.* She hit a rock near the Glenans outside of

Concarneau, stove a hole in her bottom, and before she could be towed to safety took a plunge to Davy Jones' locker. No lives were lost on either sinking. During the sweeping operations covering almost a year there was not a single casualty to a ship from a mine, although mines had been exploded in the sweep on more than one occasion. After the armistice, and after the sweepers had completed all the post-war dragging to insure no remaining mines, they were ordered to Brest to fit out for the trip back to the States. They started out for home, nine of them, all gaily decorated for the westward voyage, but before twelve hours had elapsed the Bay of Biscay had swallowed up three of the sweepers, the *James, Courtney,* and *Douglas,* and one of the large tugs that had come to assist them, the *Gypsum Queen.* The six sweepers that remained afloat got back to Brest, they had a battle royal to do it, and the fight against an almost forlorn hope is a bright spot in perpetuating the traditions of the service. All thought of trying to bring these six boats home is now gone, they are worn out, their machinery needs repair, and they are to be sold for what they can bring. This is the sad fate of Squadron Four the only U. S. mine sweepers that operated during hostilities off the coast of France where the enemy mining was a menace to the transportation of troops.

There was never an idle nor a dull moment for the sweepers. They were handy for all sorts of duty. We answered nearby calls for help, patrolled suspected areas, listened in frequently at night for the submarines, assisted in the salvage of several wrecks, rescued a few aircraft, did odd towing jobs, assisted in organizing outgoing convoys from Quiberon Bay, and all in all filled in every odd gap in the work of the district. These operations fitted in with our program of sweeping, there was never a call that we did not answer, and as you sit reading this effort, close your eyes and picture a convoy of transports arriving off the coast of France, to make the last dash for port before any submarine could get them, to have but one more menace to overcome, that of the mine fields, and to feel and know that the squadron of sweepers barely visible on the horizon have made that last part of the trip safe, and after sweeping the channels, were there to pilot the transports in to a safe anchorage, or lead them down swept channels to their final moorings in the port of debarkation.

DISCUSSION

Director Fire a Century Ago

(See Page 1097, Whole No. 209)

Rear Admiral Bradley A. Fiske, U. S. Navy.—The writer of "Director Fire a Century Ago," published in the July Proceedings, shows a surprising misconception of the essential feature of director firing, which I, as its inventor, beg leave to point out to your readers.

I made application for the patent in the United States on May 15, 1890, and in other countries shortly afterward. Naturally, I knew of the methods of concentrating the guns to hit a certain target, which the writer of the article describes, because I had made recitations on them frequently at the Naval Academy. I knew, however, that those methods were used simply to secure lateral concentration, and were effective because the distance to the target was small, as compared to the distance between the guns. I also knew that they had naturally gotten into disuse as the ranges had gradually increased.

In 1890, the main difficulty in hitting the target was in noting when the gun was at the correct angle above the horizontal, and arose from the difficulty of keeping the pupil of the eye exactly on the line joining the front and rear sights of the gun; and the difficulty increased—(and increased greatly) with any increase in the rolling of the ship. To overcome this difficulty, I invented and patented "A Method of Pointing Guns at Sea" which is now called the "Gun Director System."

The Patent Office brought forward in opposition to the claims I made a number of "references" to past and present methods and apparatus of many kinds; but finally on Sept. 9, 1890, it granted me the following claim:

"The method of pointing a gun located on a rolling, heeling or vibrating platform, which consists in adjusting a telescope, also located on said platform, and movable on a transverse axis, approximately parallel to that of the gun, at an angle to the bore of the gun equal to a certain predetermined angle *of elevation* necessary to cause the projectile fired from the gun to travel to a given target, and second noting the moment when the line of sight of said adjusted telescope is caused *by the movement of said supporting platform* to intersect said target."

Inasmuch as the Director System of to-day is exactly described by the phrases of the above claim, except that certain *additions* have been made to the original apparatus; inasmuch as it is a matter of common knowledge that the Director System is most effective (as compared with others) where the rolling is the worst; inasmuch as the writer of "Director Fire a Century Ago" states flatly "In case of heavy rolling the (marine) theodolite was *not* used to show the instant of firing, because of the

ballistic action of its pendulum, *but was employed only for conning the helm"*; inasmuch as the scheme described in his article was therefore wholly different in principle from that of the Director System; and inasmuch as the history of my invention has often been described (notably in this magazine), the appearance of this article is most disconcerting.

U. S. NAVAL INSTITUTE

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Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Annual Election

Proxies for the annual election have recently been mailed to the membership. It is requested that all members fill these out and return to the Institute as soon as possible.

Notice

Whole Nos. 6, 7, 10, 13, 14, 15, 17, 144, 145, 146, 147, 149, 155, 167, 173 and 179 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., August 15, 1920.

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PROFESSIONAL NOTES

PREPARED BY

LIEUT. COMMANDER H. W. UNDERWOOD, U. S. Navy

GENERAL ARRANGEMENT

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FRANCE

FRANCE'S NAVAL POSSIBILITIES.—The 1920 Marine Budget, amounting to nearly £40,000,000, has just been voted by the Paris Chamber after an interesting discussion, in the course of which were raised many points of international importance. The Breton Député de Kerguézec, who acted as Rapporteur du Budget, and is well known as the protagonist of a vigorous naval expansion on jeune école lines, bitterly criticized the Admiralty management, and especially the reduction of 28 per cent that has been made in the original estimates (whereas the Army Budget was only reduced by 4 per cent), and patriotically warned his countrymen against the deadly sin of indifference towards the navy. In truth, his sarcasm and reproaches were somewhat undeserved, the attitude of Messieurs les Députés showing their consciousness of the vital value of sea power to France, and their willingness to consent to all the sacrifices that may be deemed necessary in the near future. In this respect a great difference exists compared with the previous Chamber, no dissenting voice this time being heard to mar the concert of enthusiastic praise that was made of Mathurin's past and future services. Cardinal Richelieu's time-honored saying that "without maritime strength France could neither profit by peace nor successfully wage war" was solemnly recalled and unanimously applauded. Ex-Minister Thomson deplored the relative decline of the "marine républicaine," gloomily hinted at the use America and Japan might be tempted to make of their rapidly-growing supremacy, and urged "la nécessité d'un effort résolu."

From the subsequent declarations by Deputés Lecour-Grandmaison (an ex-naval officer), de Kerguézec, Boussenot, and Minister Landry, it is obvious France realizes the deep change the war has brought in the balance of sea power and the new requirements that confront her. The contest for the mastery of the ocean is virtually between the world island and semi-island powers, viz., Great Britain, the United States, and Japan. For the present America retains the supremacy on paper, but the superior

human and strategic assets of Britain were acknowledged, and de Kerguézec expressed the hope that "l'Angleterre ne se laissera pas ravir le sceptre de Neptune," and has, for the time being at least, the means of leaping promptly to her traditional place whenever she chooses, although the future might belong to the New World. Constructor Laubeuf has long since foreseen the present situation, when the mastery of the high sea would be a matter solely for island powers. Moreover, the size and cost of battleships are increasing at such a rate that only those nations can afford to build them who have practically unlimited financial resources, and are relieved by their geographical situation from the obligation of keeping a large and expensive permanent army.

France, despite her natural wealth and wonderful recuperative power, that is already asserting itself, cannot forget that the Versailles Treaty has been framed in such a way as to tie her to the guard on the Rhine, and so as to oblige her to keep a huge standing army (now over 700,000 men) in readiness to repel the aggression of a Bocheland numerically superior (over 60,000,000 people against under 40,000,00), and rendered all the more formidable by the disruption of Russia and suppression of her fleet that enables her to concentrate her efforts on the preparation of land and aerial attacks. Marshal Foch's authorized voice has just called public attention to the permanence on our Eastern frontier of a vital danger which the war has augmented rather than diminished. No wonder France should claim to have the most fought and suffered and the least gained by the war, when all points are considered. Generations will come and pass before the last traces of Boche devastation and ruin can be wiped out; and "economic reconstruction" are the words heading the programs of all our statesmen.

At the same time France means to be safe, and in waiting for the battle-cruiser program advocated by several leading admirals she intends to keep "une flotte vivante quoique réduite, et une défense des côtes parant à toute alerte possible" (Député Lecour-Grandmaison), which is the very program Minister Landry has at heart to realize. Député de Kerguézec, whose views as a future Minister of Marine deserve some attention, was even more explicit: "Pour le moment, nous n'avons pas les moyens de créer la grande armada dont le pays est digne, mais nous pouvons au moins avoir une flotte qui nous permette de rester libres de nos destinées et de choisir nos allies" ("For the present, France cannot afford to build the great armada that would be worthy of her, but she can at least be strong enough on the water to remain independent and at liberty to choose her allies"). This recalls the plea recently formulated by a well-known vice-admiral in favour of a squadron of six super-battle-cruisers, supported by aerial and submarine auxiliaries, that could be placed at the disposal of France's Allies whenever comes the great contest for the command of the Atlantic.

Whilst ex-Premier Briand stated that France and England "ont un égal besoin l'une de l'autre," stand equally in need of each other, and all orators expressed Anglophile sentiments, it cannot be denied that some misgivings and mistrust exist on the French side as to the ulterior motives of some English politicians. Deputé Boussenot, for instance, asked if, in the light of the Scapa Flow affair and of the interdictions concerning the surrendered Boche submarines, it did not look as if "notre alliée Anglaise voulait nous empêcher de reconstituer notre marine." At the same time, both leading deputés and journalists expressed their confidence in British fairness and loyalty. Ex-Minister Chaumet advocates a frank understanding with England, who, in the actual state of the world, has less interest than ever in discouraging a tried and faithful ally such as France has been. "L'Angleterre n'est plus défendue par son insularité, n'est plus une île avec les progrès de l'artillerie et de l'aviation. Nos voisins et amis doivent se rendre compte de cette situation nouvelle."

Député de Kerguézec derided the Landry program (six large scouts, 12 2000-ton destroyers, twelve 2000-ton submersibles of 28 knots, and numerous bombing seaplanes) as being inadequate, and declared he could not be satisfied with less than 94 offensive submarines, whilst Minister Landry depicted an efficient coast defence as the solid foundation of French sea power and security, and no wonder. Coast defence, that would be a negative asset in the case of Germany, means much more than the word implies for the mistress of Dunkirk, Cherbourg, Bizerta, Diégo-Suarez, and Dakar. Super-cannon, submarine and aerial flotillas could easily transform these now poorly-equipped points d'appui into formidable bases of offence, with extensive radius of action. At the same time coast defence is no longer susceptible of being efficiently organized on cheap lines. The Cuxhaven, Ostend, and Durazzo affairs point to increased possibilities on the part of coastal attack, whilst the advent of aerial and long-range bombardment requires something like a remaking of French maritime bases.—*The Naval & Military Record*, July 7, 1920.

FRENCH NAVY NOTES.—There is, among well-informed naval men here, substantial agreement on two capital points of the cruiser policy, viz., France, being financially unable to compete in numbers, possesses at least, in the tried inventive genius of her constructors and acknowledged lead of her artillerists, the means of excelling in the matter of quality, as expressed by real speed under service conditions and gun and torpedo range; secondly, the projected 5000-ton (30 knots, eight 5.5) scouts of the 1914 program, though remarkably designed, could but represent a poor investment at this stage, as the larger British, American, and Japanese cruisers, already afloat or in hand, could catch and sink them with the greatest ease just as if they were mere gun boats instead of respectable croiseurs légers. Therefore, the 1920 scouts are to be enlarged beyond 7000 tons, and, despite the claims of the new 5.5-inch that exceed 20,000 yards in range, they are to mount axially-disposed 7.6-inch weapons of new design.

Constructor Laubeuf, it is interesting to note, is in favor of limiting the rôle of the submarine, and condemns without reserve the piratical practice inaugurated by the Boche, although he considers guerre de course as quite legitimate so long as the rights of humanity can be respected—so long as the submarine is in a position to save the crews and passengers of the vessels that have been sunk. He further states that to abandon in fragile boats, in the mid-ocean, the human cargo of a sunken liner is contrary to international law, and declares it a great pity, for the sake of humanity and justice, that those who torpedoed the *Lusitania* and so many hospital ships have not been hanged as they deserve. On the other hand, he will have none of the proposed suppression of the submersible, which he derides as being both absurd and immoral, since "le sousmarin permet à une nation faible de se défendre contre une nation beaucoup plus forte en navires cuirassés." Especially, he sees in the submarine a necessity in these times of 43,000-ton battleships, which France could not build except at tremendous cost, and which Italy cannot think of constructing, as it is an antidote against bombardments and relegates battleship activitiy to the high sea.

For the next ten years, he urges, France must be content with a purely defensive policy, and make submarines the very foundation of her sea power, as submarines, single-handed, can command those seas in which the Republic has her vital interests, viz., the North Sea, the Channel, and the "whole" of the Mediterranean. Therefore, no need of huge underwater displacements. "Le grand sousmarin est inutile, même nuisible" for the twofold reason that a large submersible cruiser would cost some 35,000,000 francs (!)—thus the price of two 900-ton or of three 500-ton boats—and that in number resides mostly the efficiency of submarine warfare. What France requires to be safe and to effectively control

European waters is a very large number of submersibles of three distinct types, namely, boats of 900 tons to be improved copies of the Lagrange and of the British *L* class, and improved *Bellones* and *Armides* of 550 tons, together with minelayers of 450-500 tons, similar to the German *U C-46* type.

The contentions of the eminent originator of the submersible type, who has specialized in submarine construction, and has supplied designs to all leading navies, deserves, of course, every attention. At the same time, many of those naval men who have to handle submarines, differ from him on the questions of submarine displacements and of the actual possibilities of submarine warfare. Lieut. Jeannin, who has just summed up in an interesting volume the result of his war experience and reflections, writes on this subject: "Le sousmarin ne peut aspirer à la suprématie des océans entrevue un instant en 1917. Since the progress of detection devices and appliances has deprived it of its chief advantage, his invisibility, and made it highly vulnerable to surface ships." No doubt, numbers may minimize the danger of this growing vulnerability of the submarine, but there is much to be said for large armored submarines carrying battle calibres. The British *M* class have many admirers on this side, and the question has been considered in high quarters of building larger copies with better stability, armored decks, and adequate ammunition supplies, the plea being that vessels so equipped would enjoy a larger radius of action, as well as a much more extensive scope of usefulness than sousmarins proprement dits of the *Laubeuf* design, only carrying torpedo tubes, and consequently, limited as to their means of offence and opportunities for action. Great inventors are notoriously partial to their own creations, and Monsieur Laubeuf does not want "son submersible" to be spoiled by the adjunction of guns and armor that savor of old-time warfare.

In the matter of administration and of the utilization of the Marine Budget, the French Navy labors under difficulties that are unknown to the British naval service. Whereas the English maritime authorities, supported by the business-like instinct of the British public, have only the superior interests of the country to consider as to the way the naval expenditure is to be distributed among the various ports and branches of the service, the good-intentioned politicians who every few months keep replacing one another at the head of the naval affairs of the Republic are never completely freed from electoral pressure. Toulon publicans held indignant meetings when Admirals Germinet and de Lapeyrère took out the 30,000 odd crews of the armé navale to sea for occasional maneuvers, and now an uproar and tearful protests are raised in the Chamber when vital reasons are set forth for the suppression of the inefficient and strategically useless ports militaires of Lorient and Rochefort and of the costly state armor factory at Guérigny that was to show the way to economic and speedy production and proved a failure. State industry in any branch means inefficiency and waste, and the French Navy has had much too much of it; an attempt so far back as 1887 to do away with such a cause of weakness, by the clear-sighted Admiral Aube, brought about a Parliamentary storm and a Ministerial crisis. To-day, however, the need for strict economy, and the contempt all experts entertain for the 35,000 anarchistic parasites of the State arsenals are supporting Minister Landry in his patriotic resolve to obtain a full return for every naval penny expended. The 1920 Marine Budget, just voted, is a monument of waste and inefficiency, as demonstrated by Deputés de Kerguézec and Brousse. It was contended by Député Balanant (an ex-arsenal hand) that the prolétaires des arsenaux are in reality "braves gen" and efficient workmen. Unfortunately, facts speak clearly enough on that score. In contrast with British naval workers, who understand that their welfare is dependent on the welfare of the British Navy at large, French "ouvriers des arsenaux" go counter to the interests of the service that feeds them by sending anti-patriotic representatives to Parliament and by indulging in occasional

sabotage, without mentioning their well-established reputation for laziness and total absence of zeal, though it appears things are not quite so bad as they were and a higher rate of production is being obtained since industrial methods were introduced by Minister Leygues in the Brittany arsenals. Ex-Minister Nail wondered why ports militaires, with their superior plant, could not excel private dockyards, and the Bolshevist député Goude claimed the Brest arsenal was the best equipped in the world; all remarks that go to show that no efficiency can be looked for where there is lacking healthy emulation and respect for authority, where there are lacking also business qualifications on the part of those entrusted with the management. As was remarked by Chief Constructor Maurice, our "ingénieurs de la Marine" would easily be the first constructors in the world if their unexcelled scientific training could be completed by the practical and nautical formation that is the strong point of their British and American colleagues. The attention of the Marine Minister is just now being directed towards that capital point, as it is obvious programs of maritime renovation can be little more than make-believe without the faculty of constructing quickly and economically, and an effort is to be made to enforce stability and responsibility in the management of dockyards, together with more practical competence. On the return from America of the mission of ingénieurs d'artillerie under Gen. Charbonnier a mission of French constructors is to carry out fruitful work of investigation and comparison in Allied shipbuilding centers. Thus a further sign of the thoroughness with which France is tackling the problem of her future maritime expansion.

The 850-ton aviso *Amiens* has had the most satisfactory trials of her class, having approached 21 knots, which is creditable enough considering the faulty lines of the hull and the difficulties in obtaining good-class building materials.

Whilst no illusion is entertained concerning the fighting value of these canonnières that would fall a prey to the smallest bona-fide scout, they will, on the other hand, prove useful to show the flag and for training purposes, besides preserving some worth for submarine purposes. Their relatively large number will permit of vastly increasing the list of young officers having on their shoulders the responsibility of independent command; and independent command is par excellence the school of initiative. As has been judiciously observed here, the remarkable spirit of enterprise British destroyer and submarine commanders displayed in the course of the conflict was a reward for the freedom of action which broad-minded British admirals allowed to youthful unit commanders, whereas in the Gallic Fleet that was practically concentrated in one armée navale; every move was subordinated to the bon plaisir of the admiralissimo, whose mind was filled with the image of bataille d'escadre on conventional lines. The recent Parliamentary debate happily showed that the enhanced value of initiative under the changed conditions of warfare is being fully realized in high quarters.—*The Naval & Military Record*, July 21, 1920.

FRANCE'S MERCHANT MARINE.—During the course of the debate on the French budget last month, a lengthy discussion took place in the Chamber of Deputies on the outlook for the French merchant marine. According to the official figures submitted, the French mercantile fleet at the outbreak of hostilities aggregated approximately 2,550,000 gross tons. Of this total, 1,100,000 tons were destroyed during the course of the war. All but 120,000 tons of this lost tonnage has already been replaced. Furthermore, the French authorities count upon receiving 450,000 tons of enemy shipping, and 160,000 tons of German boats acquired by Brazil. To this should be added 330,000 tons of new British vessels to be delivered in accordance with an arrangement made during the war and 1,089,824 gross tons of shipping building for French interests at home and abroad. When all these prospective units have been delivered, France will possess a merchant marine not far from five million tons.

It should be borne in mind however, that much of the tonnage just enumerated consists of old vessels, which have seen much hard service and are sadly in need of repairs. Unless thoroughly reconditioned at a very considerable outlay, these antiquated crafts cannot be profitably operated in competition with the enormous number of new cargo-carriers turned out in American and other yards during the last few years. Where the French with their depleted man power are going to find sailors to operate a merchant fleet twice the size of the one they had in commission before the war is a yet unsolved problem. That such seamen as are available are not especially amenable to discipline is evidenced by the fact that no less than thirty-three strikes occurred among them between January 19 and June 11 last.

While France in a short time will have developed her merchant marine on a scale undreamt of six years ago, a plan for the efficient use of this greatly enhanced merchant fleet has yet to be worked out. Nearly two-fifths of the tonnage under the tri-color is being operated by the government and the owners of these requisitioned vessels are not hankering after their speedy return as the onus of finding employment for these craft would then fall on them. One factor operating at the moment against the employment of much shipping in the coastwise trade is the neglected condition of the French secondary ports. For the last five years their upkeep has been entirely neglected with the result that they have become more or less silted and their quays have in many instances fallen in. So although the outlook for the French merchant marine appears roseate on paper, much remains to be done before this alluring vision of a great and prosperous fleet of ocean carriers under the French flag can become a reality.—*The Nautical Gazette*, July 24, 1920.

GERMANY

GERMAN SUBMARINE ENGINES.—This is the first instalment of a long article by a well-known German marine engineer.

"After a few words on general matters, the author states that the original German machines ran at 450 r. p. m., compared with 330 and 300 r. p. m. of two well-known makes of English machines; however, this speed of 450 r. p. m. was eventually reduced to 350. Materials presented some difficulty at one time, but eventually this was overcome by the improvement in steel foundry work. Steel and iron were used for all the large castings, which in the ordinary way would have been made of bronze. The cylinder covers, the valve chambers, and pistons were all made of cast-iron, the parts being specially prepared and cleaned up by sand blasting. The crank-shaft and driving shafts were of special steel, with a strength of 55 kg./sq. mm., all shafts being hollow. The crankshaft and other large bearings were of steel, with white-metal lining. The usual copper pipes for water connections were also of iron, leaded in the inside. The tests to which the engines were put were very thorough, consisting of seven days' continuous runinng, and 142 hours under full load. After these tests, the machine was completely dismantled for a thorough inspection. The principal tests were made when the engines were already in the ship, during which all conditions as regards weather, etc., were experienced. The author then proceeds to describe a 1,150 h. p. engine manufactured by Krupp and Co. This is the type of machine fitted to the *Deutschland* and *Bremen*, and also to the German-American Petroleum Co.'s tank ships, only in the latter case the engines are 4-cycle. Sectional drawings are reproduced of the engine at various points showing the working cylinder, lubricating pump, and fuel pump. Also indicator diagrams are shown, taken from this engine. The author describes a Diesel engine manufactured by the German Daimler Co., of 530 h. p., which is also illustrated by drawings. These machines have been gradually developed from the smaller type. 60 h. p., made in 1908." (M. W. Gerhards, *Der Motorwagen*, May 20, 1920.)—*The Technical Review*, July 6, 1920.

GERMAN NAVAL CONSTRUCTION, 1914-1918. *No. I.*—Information lately to hand from Germany supplements our previous knowledge of the naval shipbuilding programmes framed in that country during the war period, and throws a new light on the ambitious schemes that were entertained by the German naval authorities. It reveals no less clearly the indecisive and constantly changing views of the German Naval Staff with regard to the most promising methods of conducting the war at sea. For the first two or three months of the conflict they appear to have put implicit faith in the conventional weapons of naval combat—capital ships, cruisers, surface torpedo craft, and so on—to the virtual exclusion of the submarine. Not until the specular success of Lieut. Commander Otto Weddigen in sinking the three *Cressys* was anything done to enlarge the prewar programme of submarine construction. From October, 1914, confidence in the supposed unique powers of underwater craft dominated shipbuilding policy for a time, but by the summer of 1915 the palpable failure of the first submarine offensive against merchant shipping had caused the pendulum to swing back again, bringing the capital ship into favor once more. In fairness to Grand-Admiral von Tirpitz, it should be recorded that as long as he remained Secretary of the Navy a certain equilibrium was maintained in respect of naval construction. His purpose was to build the largest possible number of capital ships, cruisers and destroyers, in addition to submarines, believing, as he then did, that the war would end without a positive decision as between Germany and Great Britain, and that Germany's prospects thereafter would depend on the strength of her fleet. Moreover, he shared the common German view that the war would be of brief duration, and for that reason he did not consider it necessary to expedite the completion of the larger types of warships. Work on the battleships and battle-cruisers proceeded, therefore, at a leisurely pace, and was finally brought to a standstill through lack of materials and the preemption of labor for executing the huge submarine programmes introduced at a later date.

After von Tirpitz had been dismissed in March, 1916, something like confusion seems to have prevailed in German naval circles on the subject of shipbuilding policy, and various projects were adopted and cancelled with bewildering rapidity. To illustrate this confusion of ideas, it may be mentioned that immediately after the Battle of Jutland a decision was reached to lay down several capital ships of unprecedented size and power. Their dimensions can only be conjectured, but some notion of them is conveyed by the fact that the machinery for the battleships was to develop 160,000-shaft horsepower and that for the battle-cruiser 300,000-shaft horsepower—as compared with the 75,000-shaft horsepower of *Queen Elizabeth*, our fastest battleship, and the 144,000-shaft horsepower of the *Hood*, the largest battle-cruiser in the world. It does not appear that any of the projected German leviathans got beyond the designing stage, but the very circumstance that capital ships of this phenomenal size were seriously contemplated towards the third year of the war proves that the submarine did not by any means monopolise German interest. Eventually, a modified type of battle-cruiser, inspired by the British *Renown* class, was decided upon, and three vessels of this type were ordered in 1916. They are generally referred to in foreign naval text-books as the *Graf Spee, Prinz Eitel Friedrich* and *Ersatz Hansa*, but in Germany were officially designated *Ersatz Yorck, Ersatz Gneisenau* and *Ersatz* "A."

Although, as we have said, the design was inspired by our *Renown* class, the three German ships were considerably larger and had better protection. Their displacement at normal load was 33,500 tons, and their machinery—turbines, with Föttinger transformers—was to develop 110,000 shaft horsepower, the speed being estimated at a fraction above 30 knots. Revolutions per minute—turbines 1360, propellers 315. The system of protection was practically identical with that of the *Derfflinger*, viz., a 12-inch waterline

belt, 10½-inch barbettes and a 7-inch plating on the sides above the main belt, including the secondary battery. The main armament was to have consisted of six 15-inch 45-calibre guns, in three turrets, one placed on the forecastle and two on the afterdeck, No. 2 turret superfiring over No. 3. This was a reversal of the turret disposition in H. M. S. *Renown*, but was in harmony with the German principle of concentrating the heaviest possible fire astern. The 15-inch guns were given an angle of elevation up to 35 degrees. Sixteen 5.9-inch quick-firers were to form the secondary armament, and there were six tubes of the new 23.6-inch pattern. None of the trio was ever completed. The *Graf Spee* (*Ersatz Yorck*) was launched in September, 1917, after which very little work was done to her, and at the date of the Armistice the other two vessels were lying neglected on the stocks at Wilhelmshaven and Hamburg respectively.

The two battleships actually laid down in Germany during the period under review, viz., the *Württemberg* and *Ersatz Kaiser Wilhelm der Grosse*, call for little notice, since they were respectively the fourth and fifth units of the well-known *Bayern* class, comprising the nameship, the *Baden* and the *Sachsen*. These vessels are often referred to as "copies" of H. M. S. *Queen Elizabeth*, whereas, in fact, the two types have not much in common. Hitting and resisting power, rather than speed, are the essential characteristics of the *Bayerns*. Against the *Queen Elizabeth's* 25 knots, they were designed only for 21 knots, and their lines are altogether different, as the following comparison shows:

	Length overall	Beam	Draught
Queen Elizabeth	643¾ ft.	90½ ft.	30½ ft.
Bayern	623 ft.	99¾ ft.	28½ ft.

The *Bayern* also carried from 2000 to 2500 tons of additional armor, and her internal protection was on a scale elaborate even when judged by the German standard, which is very high indeed. Her 15-inch guns were of greater power—45 calibers, compared with 42 calibers in the British ship—and were served by special machinery which permitted an exceptionally high rate of fire. These ships are no less remarkable by reason of their horizontal protection against trajectory fire. The *Bayern* herself was scuttled at Scapa Flow in June, 1916. Her sister, the *Baden*, escaped the same fate, thanks to the smart work of the British salvage officers, who succeeded in raising the ship from the shallow water in which she had settled down. Having been allotted to this country by the Allied Naval Council, the *Baden*, it is understood, will be expended as a target ship for the Atlantic Fleet some time this year. The *Sachsen* and *Württemberg* were launched during the war, but not completed; and the fifth ship, *Ersatz Kaiser Wilhelm der Grosse*, never progressed beyond the framing stage. The *Technische Rundschau* some months ago mentioned that the new German battleships intended to follow the *Bayerns* were to have mounted ten 15-inch or "eight guns of still larger caliber, the advantages of the heaviest artillery having been at that time fully appreciated in German naval circles."

On the outbreak of the war the only armored vessel being built in Germany to foreign order was the Greek battleship *Salamis*. In 1912 the contract for this ship had been secured by the Vulkan Company, thanks in large measure to the energetic support of the German diplomatic representative at Athens, and the keel was laid at Hamburg on July 23rd, 1913. The dimensions, etc., were as follows:—Length, 570 feet 9 inches; beam, 82 feet; draught, 25 feet 3 inches; displacement, 19,500 tons. Machinery: Curtis-A. E. G. turbines of 40,000-shaft horsepower; speed 23 knots. Armament: Eight 14-inch 45-caliber guns, twelve 6-inch and twelve 12-pounder quick-fires, three torpedo tubes submerged. The contract for the armament was secured by the Bethlehem Steel Company, but the war supervened before delivery could be made, and eventually the eight

14-inch guns manufactured for the *Salamis* were purchased by the British Government and used to arm four monitors—*Abercrombie, Havelock, Raglan and Roberts.* It was naturally assumed that Germany would complete the *Salamis* for duty with her own fleet, but she did not do so. Launched on November 11, 1914, the vessel was towed to Kiel, and was there employed as a floating barrack. Whatever her ultimate fate, it is improbable that she will be completed as a ship of war.

A very considerable programme of light cruiser construction was undertaken in Germany during the war period, 16 vessels of this type having been laid down since August, 1914, though not all were completed. There were, in addition, six light cruisers already being built or completed for sea, viz., *Regensburg, Graudenz, Frankfurt, Wiesbaden, Pillau* and *Elbing*—the two last-named being Russian vessels being built by Schichau, at Danzig, and confiscated for the German Navy when mobilization was proclaimed. In common with all previous German light cruisers, the *Regensburg* and *Graudenz* carried nothing heavier than the 4.1-inch gun, 12 of which were mounted in each ship. But in the following year, after the first engagements at sea had demonstrated the inadequacy of that weapon, the armament was changed to seven 5.9-inch guns, and at or about the same time several of the earlier light cruisers were also re-armed with weapons of that caliber. It is of interest to note that the first German light cruisers originally designed to mount 5.9-inch guns were the *Frankfurt* and *Wiesbaden*, built under the 1913-14 programme. Moreover, these two ships were the largest light cruisers ever completed in Germany, a somewhat smaller design having been adopted for those laid down in 1914 and subsequently. The *Frankfurt* was 465 feet in length, 45½-foot beam, 17-foot draught, and displaced 5120 tons. Her speed was 28 knots, and the main armament eight 5.9-inch guns. Her sister ship, *Wiesbaden,* was sunk in the Battle of Jutland, after having put up a very gallant fight, to which the British despatches paid generous tribute. The *Pillau* and *Elbing*, as completed for the German Navy, displaced 4320 tons, and had turbines of 27,400-shaft horsepower, giving a speed of 27.5 knots. Their steaming endurance at 10 knots was 6600 nautical miles, and they mounted the same armament as the *Wiesbaden.* The *Karlsruhe* and *Königsberg*—both named after vessels lost early in the war—although laid down after the outbreak of war, had been authorized under the normal 1914-15 programme. Their dimensions, etc., which became more or less a standard for the majority of the war-built cruisers, were as follows: Length, 450 feet; beam, 43 feet 6 inches; draft, 16 feet; displacement, 4200 tons; speed, 28.5 knots; fuel, 1240 tons coal, 500 tons oil; armament, eight 5.9-inch, two or three 22-pounder A. A. guns, two deck and two submerged 19.7-inch torpedo tubes. Of this class, besides the *Karlsruhe* and *Königsberg*, there were actually built: *Emden, Nürnberg, Köln, Dresden;* and of the eight cruisers being built, but incomplete at the date of the Armistice, four at least are understood to have been of the *Karlsruhe* class. Owing to the disposition of their 5.9-inch guns, these vessels were able to train four guns ahead or astern, and were thus superior in end-on fire to contemporary British cruisers. On the other hand, the great weight of armament at the bows caused the German ships to pitch violently in rough weather, and from all accounts they were indifferent seaboats.

At the beginning of 1915—that is, before the first mine-laying submarines had been completed and when the value of underwater craft for this work was still problematical—the Germans designed two light cruisers of a new type for the special duty of long-distance mining operations. Both vessels, *Brummer* and *Bremse*, were assigned to the Vulkan Yard, Stettin, and completed respectively in March and July, 1916—or in little more than 12 months from the laying of the keels. This was creditable achievement in view of the dimensions of the vessels:—Length, 430 feet; beam, 41 feet; draught, 15 feet 6 inches; displacement, 4000 tons.

Turbine machinery originally built for a Russian contract was appropriated for these ships, each of which had engines of 46,000-shaft horsepower for a speed of 30 knots. Their bunker capacity of 550 tons of coal and 1190 tons of oil fuel gave them a very extended cruising radius. They were armed with four 5.9-inch guns on the center line, two 22-pounder A. A. guns and four torpedo tubes, and provision was made for carrying 300 mines. The scantlings were extremely light, and the structure of the hull bore traces of hasty workmanship. It is now known that an attempt was made to give these ships the outward appearance of British light cruisers, as they were intended to operate in enemy waters, but when completed they bore no marked resemblance to any British ship, and when they raided the Scandinavian convoy in October, 1917, their identity as German cruisers was easily established at the limit of visibility. On that occasion, it will be recalled, sank the destroyers *Mary Rose* and *Strongbow* and a number of neutral merchantmen. This was the only successful enterprise which the *Brummer* and *Bremse* appear to have carried out, and there is reason to believe that their general structure and machinery proved too fragile to stand the strain of North Sea campaigning.

Two light cruisers, *Ersatz Emden* and *Ersatz Köln*, begun in 1917 at Kiel and Bremen respectively, but abandoned before launch, are reported to have been of an exceptionally large and powerful type, primarily intended for commerce destruction. They were to have displaced between 7000 and 8000 tons, with a sea speed of 30 knots, and the armament was to have included several heavy guns, probably 8.2-inch. It is not to be doubted that raiders of this type would have been a formidable menace. The appearance of even one or two on the trade routes must have led to a drastic revision of our convoy arrangements, necessitating the addition of cruisers sufficiently fast and powerful to deal with the newcomers. In the latter part of 1914 the bare rumor of a contemplated cruiser attack on the Canadian convoy impelled the Admiralty to detach a battle-cruiser from the Grand Fleet. It will be seen, therefore, that the Germans missed a great opportunity of playing havoc with our naval dispositions, and perhaps of seriously weakening the one force that stood between them and the attainment of their war aims—The Grand Fleet. From the technical standpoint, their light cruisers of the war period exhibit no remarkable features. Geared turbines, first introduced in the *Karlsruhe*, of 1913, were gradually adopted for nearly every type of ship. Alive as they were to the benefits of oil fuel, the Germans were in the unfortunate position of being unable to take full advantage of it, owing to the uncertainty of supply. Consequently, only the destroyers were built on a purely oil-fired basis, and—as we shall see later—at one period of the war the oil supply ran so short that the advisability of reverting to coal-burning boilers for these boats was seriously considered. All the capital ships and light cruisers completed within the period under review were equipped with two types of boilers, one type for solid and the other for liquid fuel. In the battleships the percentage of oil-fired boilers in the total generating plant was 42 per cent; in the battle-cruisers, 45 per cent, and in the light cruisers, 52 per cent. An exception was made in the case of *Brummer* and *Bremse*, the majority of the boilers of which were fired with oil. The capital ships projected, but never completed, were to have had 70 per cent of their generating plant fired with oil. Throughout the war the steaming efficiency of larger German warships was impaired by the indifferent quality of the coal supplied, and to that factor must be attributed, at least in part, the poor speed of their battle-cruisers at Jutland. The trouble was mitigated to some extent by introducing a system of water-cooled firebars, but this, of course, reacted on the thermal efficiency of the boiler, and towards the close of the war an improved method of air cooling was adopted.

As mentioned above, the decision to mount 5.9-inch guns, firing a 101-pound projectile, in place of the 4.1-inch 35-pounder, as the main armament

of light cruisers had been come to before the war. German naval critics now admit that the retention of the 4.1-inch gun for so long was a grave error of judgment. With regard to the general design and construction of light cruisers, Great Britain may safely claim to have held the lead before and during the war. The protection of our ships, both above and below water, was remarkably good, and they proved better able to withstand punishment from gunfire and torpedoes than their German contemporaries.—*The Engineer*, June 4, 1920.

GERMAN NAVAL CONSTRUCTION, 1914-1918.—*No. II.*—Before the war the German torpedo service enjoyed an exceedingly high reputation, and was considered by many authorities to be the most efficient organization of its kind in the world. Even in the British Navy there were officers who believed the Germans to be ahead of us in the design of boats and the training of personnel in torpedo tactics. This view was not confirmed by war experience, and we may recall with pardonable satisfaction that it was traversed by an article published in *The Engineer* some months before the outbreak of hostilities, in which the characteristics of each group of German destroyers—or "Grosse Torpedoboote," to use the official designation—were examined and criticised in some detail. The truth appears to be that the development of the torpedo service had been influenced by the same erroneous conceptions of sea strategy that stultified German naval policy throughout the war. The evidence of such competent witnesses as Grand Admiral von Tirpitz and Admiral Scheer proves that those who were responsible for the creation and direction of Germany's naval forces had so far misread history as to infer that the British Navy, in the event of war, would forthwith proceed to dash itself to pieces against the German coast. Every preparation had been made for this contingency. The approaches to the coast were guarded by formidable batteries, for the cost of which an extra squadron of battleships might have been built; and the matériel of the German fleet was designed with a special view to fighting under the lee, as it were, of the German coast. All the heavy ships were built primarily as floating fortresses, so armored and otherwise protected as to be practically unsinkable; but with a limited sea endurance and only makeshift accommodation for the crews, who were expected to spend most of their time in barracks ashore. As for the destroyers, this term was truly a misnomer when applied to the German craft; the official label of "large torpedo-boats" described them with greater accuracy. They were well-built, fast and weatherly boats, carrying a heavy armament of torpedo tubes, but signally deficient in gun power. But in the German scheme of torpedo tactics the gun counted for very little. By daylight the boats were intended to work with the battle-fleet or with light cruisers, under the cover of whose guns they would fire torpedoes at long range against the enemy's line; whilst in the hours of darkness they would deliver torpedo attacks at short range, trusting to their invisibility and speed to make good their escape. It did not seem, therefore, that any useful purpose would be served by giving them a powerful armament of guns. In harmony with these principles, the majority of the boats ordered before the war mounted nothing heavier than the 3.4 inch gun. But at a very early period of the struggle the Germans found reason to modify their appreciation of destroyer functions. It was, as they discovered, not always possible to employ these boats in conjunction with heavy ships and cruisers, and when left to face unsupported the superior armament of British and Russian destroyers they were generally worsted. This was geschütz," a 3.4-inch model of 30 calibers, with a muzzle energy of only 485 foot-tons and a maximum range of 8000 yards. An improved model of the same caliber had been complete in 1912 or 1913, and was mounted in the boats of the normal 1913-1914 programmes. This was 45 calibers in length, and had a semi-automatic breech-block which materially acceler-

ated the rate of fire. It discharged the 22-pound high-explosive projectile and was therefore but little behind the British 4 inch 25-pounder in destructive effect. The boats in question had three of these improved guns mounted on the center line. The 4.1 inch model, which subsequently became the standard armament in German destroyers, was first introduced in four boats, *G41* and *42* and *V 47* and *48*, ordered in April, 1914. With a length of 45 calibers and mounted on a special carriage which permitted almost vertical elevation, it could be used either for flat trajectory or anti-aircraft fire, and was remarkably accurate up to 12,000 yards. The shell used weighed 38½ pounds. Our reply to this formidable weapon was the 4.7 inch gun, with which our later flotilla leaders and the second group of "*Almiralty V's*" are armed. But the Germans meanwhile were preparing to "go one better." In the summer of 1916—that is, after the Battle of Jutland, in which there had been a great deal of destroyer fighting at close range and weight of gunfire proved decisive—they produced a new type of destroyer, the principal feature of which was a gun armament of extraordinary power. These 12 boats, each mounting four 5.9 inch guns, will be described later, but their armament alone indicates the revolution which less than two years of war experience had brought about in the original German theory of torpedo-boat tactics.

Before proceeding to tabulate the successive groups of "large torpedo-boats" completed during the war a few words may be said about the characteristics common to all German surface torpedo craft. As mentioned above, they were remarkable for great structural strength. A rigid economy in weight was practiced, and every effort was made to keep the profile of the boat as low and inconspicuous as possible. To facilitate quickness in maneuvering, a bow rudder was fitted. This was said to reduce the turning circle by at least 25 per cent. When not in use the bow rudder was withdrawn into a recess to avoid fouling mines or other obstacles. As in the larger vessels, the living quarters were extraordinarily cramped and primitive, and to those who have inspected the surrendered German destroyers, it will always remain a mystery how their crews contrived to live at sea. All but the latest pre-war boats carried four torpedo tubes, two of which, mounted on the center line, could be trained on either beam, while one tube was placed on each side between the break of the forecastle and the bridge. The boats laid down in 1913 were given two pairs of tubes on the center line, bringing the total number of tubes up to six, and this armament was perpetuated in later boats. In the boats of the 1911 and 1912 programmes an attempt was made to reduce displacement without prejudice to other qualities. These 24 craft, *V 1–6*, *G 7–12*, and *S 13–24*, displaced only 560 to 570 tons, and were thus 17 per cent smaller than their immediate predecessors, though with the same armament and speed. The reduction in size was made possible by increasing the proportion of oil fuel to coal in the boiler furnaces; but the boats were not altogether successful, and in 1913 a return was made to larger dimensions. The boats of that year's programme, *V 25–30* and *S 31–36*, embodied several noteworthy improvements. Not only were they armed with three 3.4 inch 45 caliber guns and six 19.7 inch tubes, as compared with two 3.4 inch 30-caliber guns and four 19.7 inch tubes in the preceding type, but for the first time oil-fired boilers were exclusively adopted, an innovation that enabled a nominal speed of 34 knots to be attained. In this class, also, the system of firing all torpedo tubes from the bridge was first introduced, and the artillery control arrangements were greatly improved.

It was with considerable trepidation that the Germans belatedly followed our example in using only oil fuel in their destroyers. They were, of course, fully conscious of its advantages, but the precariousness of supply, especially in time of war, caused them to hesitate before committing themselves to an "all-oil" policy. These misgivings were justified in the course

TABLE I.—GERMAN DESTROYERS COMPLETED DURING THE WAR

Number and designation	Length overall, ft.	Beam, ft.	Mean draught, ft.	Normal displacement, tons	Oil capacity, Normal / Maximum, tons	Maximum endurance at 20 knots (nautical miles)	Trial results: Best run, Speed	Trial results: Mean of 6 runs, Speed	Armament	Remarks

TABLE I.—GERMAN DESTROYERS COMPLETED DURING THE WAR

Number and designation	Length overall, ft.	Beam, ft.	Mean draught, ft.	Normal displacement, tons	Oil capacity, Normal / Maximum, tons	Maximum endurance at 20 knots (nautical miles)	Trial results: Best run S.H.P.	Best run Speed knots	Mean of 6 runs S.H.P.	Mean of 6 runs Speed knots	Armament	Remarks
Six boats: V 25–30	257.6	27.23	8.79	800	90/232	1680	24,300	38.2	22,260	36.8	3 3.4in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered April, 1913. First boats delivered in 7½ months.
Six boats: S 31–36	261.16	27.23	7.84	790	90/220	1250	22,180	34.9	22,180	34.7	3 3.4in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered April, 1913. First boats delivered in 12 months.
Four boats: G 37–40	261.16	27.23	8.89	872	110/298	1685	25,800	35.12	25,000	34.4	3 3.4in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered April, 1914. First boats delivered in 14 months.
Two boats: G 41–42	272.31	27.23	9.05	960	166/325	1715	25,000	34.6	25,000	34.18	3 4.1in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered April, 1914. First boats delivered in 17 months.
Four boats: V 43–46	261.16	27.23	8.95	831	90/280	1750	25,400	37.5	24,660	36.91	3 3.4in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered April, 1914. First boats delivered in 9½ months.
Two boats: V 47–48	272.64	27.23	9.31	948	179/338	1985	23,850	35.3	22,940	34.87	3 4.1in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered April, 1914. First boats delivered in 12½ months.
Four boats: S 49–52	261.16	27.23	7.84	790	90/251	1345	24,610	37.1	24,610	36.36	3 3.4in. 45 cal. 6 19.7in. tubes 24 mines.	First war boats. Ordered Aug. 6, 1914. Delivered in 10 months.
Fourteen boats: S 53–66	273.39	27.23	8.30	905	162/305	1960	25,013	35.7	25,000	35.13	3 4.1in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered Aug. 6, 1914. First boats delivered in 8 months.
Eighteen boats: V 67–84	269.01	27.23	9.21	950	160/317	1810	22,600	36.6	22,600	34.35	3 4.1in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered Aug. 6, 1914. First boats delivered in 9 months.
Twelve boats: G 85–96	272.31	27.23	9.05	956	166/325	1960	26,300	34.2	26,100	33.72	3 4.1in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered Aug. 6, 1914. First boats delivered in 14½ months.
Six boats: V 125–130	269.03	27.23	9.15	907	167/330	1695	25,500	34.68	25,150	34.63	3 4.1in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered June 28, 1916. First boats delivered in 8½ months.
Nine boats: S 131–139	272.31	27.26	8.36	910	162/305	1530	24,000	34.61	23,800	33.74	3 4.1in. 45 cal. 6 19.7in. tubes No mines.	Ordered July 15, 1916. First boats delivered in 8 months.
Two boats: H 145–146	279.86	27.39	9.31	990	166/332	1840	23,788	33.56	23,800	33.33	3 4.1in. 45 cal. 6 19.7in. tubes No mines.	Ordered Nov. 15, 1916. First boat delivered in 16 months.
Six boats: B 97–98, 109–112*	321.53	30.67	9.38	1354	150/526	2620	40,800	38.09	40,217	37,51	4 4.1in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered Aug.–Oct., 1914. First boats delivered in 4¾ to 5 months.
Two boats: V 99–100*	324.81	30.71	9.22	1313	150/518	2250	42,850	37.85	42,475	37.67	4 4.1in. 45 cal. 6 19.7in. tubes 24 mines.	Ordered Aug. 10, 1914. Delivered in 7½ months.
Four boats: G 101–104	312.67	30.18	9.05	1198	150/499	2420	29,400	33.72	28,650	32.96	4 4.1in. 45 cal. 6 19.7in. tubes 24 mines.	Ex-Argentine boats. Modified to German design, Aug., 1914. Built in 15 months.
Twelve boats: S 113–115, V 116–118, G 119–121, B 122–124	360 30	36.23	13.04	2400 2485	210/720	3200 (?)	56,000	36.9	54,000	35,30	4 5.9in. 40 cal. 4 23.6in. tubes No mines.	Ordered July–Aug., 1916. First delivered May, 1918. Proved unseaworthy on trial. None commissioned before Armistice.

* These eight boats were fitted with machinery originally built to Russian contracts.

of the war, for at one time, when no less than 84 destroyers with oil-fired boilers were under construction, the supplies from Galicia and Roumania threatened to cease entirely. Stocks were low at this time, and the position was rendered still more critical by the rapidly increasing consumption of oil by the submarine flotilla. So serious, indeed, was the outlook, that a decision was reached to reconvert all destroyers then under construction back to a coal-burning basis, a measure which naturally caused great delay in their completion, involving as it did drastic alterations in structure. Eventually, however, the reserve of oil was enlarged by increased production from domestic sources and by the use of German tar oil, expedients which enabled the 84 boats to be completed to the original oil-burning design though the contract date of delivery was exceeded in every case. As the war proceeded it was found that boats of the pre-war dimensions were not sufficiently large to perform the multifarious and exacting duties that devolved upon them. Their cruising endurance proved to be inadequate, and in heavy weather their speed was so reduced that they could not keep pace with the heavy ships. Moreover, there was an insistent demand for a better armament of guns, torpedo tubes and mines, which could not be met without a large jump in displacement. To meet these various requirements a number of boats in an early stage of construction were cut in half and lengthened on the slip. Throughout the war improvements were continually made in the fighting equipment of the boats, culminating at length in an elaborate system of control for guns and tubes, the installation of electric range transmitters, training pointers, long-base telemeters, etc. A certain number of boats, specially detailed for anti-submarine work, were fitted with explosive sweeps, and others with a German adaptation of the paravane for mine clearance. In the later stages of the war, all mine-laying on the German side was done by submarines, and mines and laying gear had been removed from the destroyers. It must be remembered that after the first year of hostilities the pressure of the blockade began to make itself felt in every branch of German industry. Shipbuilding of every description was hampered by ever-growing difficulties, due both to shortage of materials and to the reduced efficiency of the workers. From the summer of 1915 onward the acute scarcity of copper and tin left the builders no alternative but to use iron extensively in the construction of destroyers, the increased weight of which had, of course, a prejudicial effect on speed. In the penultimate year of the war, after many fruitless attempts had been made to design boats embodying all the requisite qualities of speed, seaworthiness, armament, etc., in a small displacement, plans were got out for a standard type of destroyer, about 40 of which were ordered during 1917. This type was to be of 1500 tons—*i. e.*, nearly twice the weight of the typical pre-war boat—and to have a speed of 36 to 37 knots. Of these boats, which differed from earlier types in that they were to have been equipped with geared turbines, none was complete at the date of the armistice, and all have since been dismantled.

In addition to destroyers, nearly 120 small torpedo-boats for coastal work were ordered during the war. They were know as "A" boats, and were divided into three classes, I, II, and III, according to their displacement and date of design. Practically all the important shipbuilding yards in Germany were employed on destroyer and torpedo-boat construction in the war period, and to the three establishments which formerly specialized in this work, viz., Schichau (Elbing), Krupp-Germania (Kiel), and Vulkan (Stettin and Hamburg), were added the Blohm and Voss (Hamburg), Howaldt (Kiel), Weser (Bremen), Lübecker Maschinenbau-A. G. (Lubeck), and Nobiskrug (Rendsburg) yards, all of which built hulls as well as machinery. One or more destroyers of a large type were laid down at the Wilhelmshaven dockyard. In the same way contracts for the hulls, machinery and fittings of the "A" torpedo boats were distributed among many firms. It is interesting to note that boats of the A I and A II classes

TABLE II.—(GERMAN TORPEDO BOATS COMPLETED DURING THE WAR)

Number and designation	Length overall, ft.	Beam, ft.	Mean draught, ft.	Normal displacement, tons	Oil capacity, Normal/Maximum, tons	Maximum endurance at 20 knots (nautical miles)	Trial results: Best run. S.H.P.	Best run. Speed, knots	Mean of six runs. S.H.P.	Mean of six runs. Speed, knots	Armament	Remarks
A I. Class— Twenty-five boats: A 1-25	136·32	15·09	4·13	107	—/23·8	440 (at 19 kts.)	1125	20	1084	18	1 4-pr. 2 17·7in tubes 4 mines	Ordered Sept., 1914 First boats delivered in 3 months
A II. Class— Twenty-four boats: A 26-49	164·37	17·45	6.04	228	45/53	975	3500	26·3	3300	25.8	2 3.4in. 30 cal. 1 17.7in. tube	Ordered Dec., 1915 First boats delivered in 6 months
Six boats: A 50-55	164·37	18·44	6·03	229	45/55	840	3500	25·7	3300	24·7	2 3.4in. 30 cal. 1 17.7in. tube	Ordered July, 1916 First boats delivered in 4½ months
A III. Class— Twenty boats: A 56-66, A 80-82, A 86-91	196.85	21.03	5·90	329	85/91	805	6050	28.38	5960	25.39	2 3.4in. 30 cal. 1 17.7in. tube	Ordered July, 1916, March, July, 1917 Built in 5½ months
Sixteen boats: A 68-79, A 92-95	196.92	21.06	6.26	354	76/82	725	5800	27.01	5800	26.2	2 3.4in. 30 cal. 1 17.7in. tube	Ordered July, 1916 and July, 1917 Built in 5½ to 6 months
Four boats: V 105-108	200.13	20.37	6.36	349	30/59 coal 5/16 oil	640	6000	30.01	5905	29.96	3 3.4in. 45 cal. 3 17.7in. tubes 12 mines	Originally begun for Holland. Appropriated Aug. 10th, 1914. Built in 12 months.

were built in sections, railed to distant bases, such as Bruges and Pola, and reassembled there.

Immediately after mobilization had been proclaimed, contracts were placed for 48 destroyers of the so-called "*Ms*" type (Ms=mobilization). From that date to August 1, 1918, a further 264 destroyers and coastal torpedo-boats were ordered, bringing the total number of surface torpedo craft ordered during the war period to 312, with an aggregate of 299,457 tons. Owing, however, to various delays resulting from causes mentioned above, little more than half this programme had been completed when the armistice supervened, the deliveries to that date being 197 boats of 147,910 tons. The number of boats ordered from and the number actually delivered by the various yards is given in the following table:

	War contracts		Deliveries	
	Boats	Tons	Boats	Tons
Blohm and Voss	9 of	18,129	6 of	10,740
Germania Yard	28 of	37,834	22 of	27,046
Howaldt Yard	27 of	35,819	2 of	2,266
Schichau Yard	109 of	95,781	79 of	49,362
Vulkan Yards	138 of	110,761	88 of	58,505

Included in the above totals are four large destroyers which at the outbreak of war were being built at the Germania yard, Kiel, for the Argentine Government, and four torpedo-boats being built at the Vulkan yard for the Netherlands Navy. These vessels were at once appropriated for the German service.

The trial results given in the tables are not a fair indication of the sea speeds actually attained by German destroyers completed during the war. Owing to the vigilance of our submarines and the activity of our minelayers, the waters of Heligoland Bight soon became too dangerous for steam trials, the venue of which had to be transferred in the third month of the war to the western Baltic, where the shoal water is unfavorable to speed trials under practical conditions.

As will be seen from Tables I and II every German destroyer completed within the period under review mounted the standard torpedo armament of six tubes. In the case of the two sets of twin tubes on the center line, the axes of each pair were so fixed that the forward ends of the tubes diverged at an angle of 15 degrees. This arrangement was the outcome of experience, which showed that when two torpedoes were discharged simultaneously from a pair of tubes mounted in parallel, the practice was not so accurate as when two torpedoes were fired in succession. The angle of divergence of the tube axes was determined by careful experiment, and was considered to offer the best chance of hitting, both at short and long ranges. There can be no question as to the all-round efficiency of German torpedoes. The standard torpedo for use in destroyers was the "G 7" 50 cm. (19.7 inch) steam heater model, with a length of 7 m. (22.97 feet), and a warhead containing 430 pounds of explosive. This weapon had a range of 5500 yards at 35 knots speed, and of 11,700 yards at 28 knots. A smaller model, the 45 cm. (17.7 inch) bronze torpedo, with a charge of 198 pounds of guncotton, was employed by the earlier torpedo craft, and it was with this weapon that the Submarine *U-9* was armed when it sank the three "*Cressys*." An improved 45 cm. torpedo produced during the war contained a charge of no less than 330 pounds of explosive, consisting of T. N. T. blended with "Hexa," a mixture * said to be 30 per cent more powerful than wet guncotton. But effective as the 17.7 inch and 19.7 inch torpedoes proved to be against most targets, a still more destructive charge was needed to overcome the minute subdivision of the modern

* This mixture was known as "Hexanitrodyphenylsulphide," and was credited with an explosive energy 10 per cent greater than that of T. N. T.

dreadnought, and for this purpose the Germans, in 1914, designed a 60 cm. (23.6 inch) torpedo, with a warhead of 550 pounds. This formidable engine had the enormous range of 16,000 yards, which it could traverse at a speed of 28 knots. The first vessel to be equipped with 23.6 inch torpedo tubes was the battle-cruiser *Lützow*, sunk at Jutland, and similar tubes were fitted in the "*Bayern*" class of battleships. Four tubes of 23.6 inch caliber were also mounted in the 12 huge "destroyers," or flotilla leaders, of the *S-113* type. It need hardly be said that the heavy demand for torpedoes throughout the war led to a corresponding expansion of German manufacturing facilities. In 1913, the last peace year, a total of 193 torpedoes was delivered, as compared with 774 in the month of September, 1918. In less than five years, therefore, the annual output had increased forty-eightfold.

The 12 vessels of the *S 113* type, displacing as they did nearly 2500 tons, were the largest surface torpedo craft in the world. Their nearest rivals in point of size are *H. M. S. Swift*, 2207 tons, and the new Italian leaders of the "*Leone*" class, 2200 tons; but in weight of armament the German boats were far superior. Their four 5.9 inch 40-caliber guns—on mountings which enabled them to be used against aircraft—were disposed on the center line: one on the forecastle, one abaft the second funnel, and two at the stern, the third gun superfiring over the fourth. By this arrangement four guns could fire on either broadside, one ahead, and two astern. To operate the two pairs of ponderous 23.6 inch tubes, which

TABLE III.—COMPARATIVE TABLE OF BRITISH AND GERMAN DESTROYERS

	British "M" class	German S 53-66	British "V" class	German B 97-98	British Bruce	German S 113
Length, feet.....	271½	273	312	321½	332½	360
Beam, feet.....	26½	27½	29½	30½	31½	36½
Draught, feet.....	8½	8½	9	9½	10½	13
Displacement, tons	1,025	905	1,300	1,354	1,801	2,485
Shaft horse-power.	25,000	25,000	27,000	40,200	40,000	54,000
Speed, knots*.....	34	35	34	37½	36½	35
Oil fuel, tons.....	225/270 (average)	162/305	320/370	150/526	450/500	210/720
Armament.....	3 4 in. guns 4 21 in. tubes	3 4.1 in. guns 6 19.7 in. tubes	4 4 in. guns 4 21 in. tubes	4 4.1 in. guns 6 19.7 in. tubes	5 4.7 in. guns 6 21 in. tubes	4 5.9 in. guns 4 23.6 in. tubes
Weight of broadside (gunfire), lb.	75	115½	100	154	225	404

*It should be noted that whereas for the British boats the designed speed is given, the German figure represents the speed attained on trial. It is well known that British war-built destroyers almost invariably exceeded their designed speeds in some cases by as much as three or four knots.

were 32 feet in length, electric motors were fitted and there was a very elaborate system of fire control for the gun and torpedo armament, including a director station above the bridge. It is, however, significant that none of the twelve vessels was ever actually commissioned, though several were completed in May, 1918. Very probably they turned out to be unseaworthy, owing to the excessive weight of armament, and it is certain that the actual fighting value of the type would have proved considerably less than its characteristics suggest. It is no easy matter to handle projectiles of 101 pounds weight on the slippery deck of a destroyer, and in a seaway the rate of fire from the 5.9 inch guns must have been very slow. Still, the type deserves notice as an example of the remarkable qualities of offence which may be incorporated in a vessel of high speed and modest displacement.

In conclusion, it is instructive to compare as in Table III some British and German destroyers built during the war. Unfortunately, the steaming endurance of the British boats cannot be ascertained, but is indicated to some extent by the fuel capacity.—*The Engineer*, June 25, 1920.

GREAT BRITAIN

THE ENGINEERING BRANCH OF THE NAVY.—In the course of our leading article on the most notable events of Lord Fisher's career at the Admiralty, we alluded to the scheme of common entry and training for naval officers up to the stage when specialization in deck or engineering duties began, and pointed out that despite certain modifications which had been introduced subsequent to its adoption in 1902, fundamentally the system was still unchanged. Since we wrote on this subject, the Admiralty has given notice of a further revision which it had decided to make in regard to the position of officers who specialize in engineering duties. Some such measure was clearly foreshadowed in the First Lord's statement on Admiralty policy issued last March, in which document the necessity for a final separation between the deck and engineer officers of the naval service was emphasized. One passage in the statement read as follows: "There is a definite distinction both as regards knowledge and capabilities between those who are to be trained in the science of naval war and strategical and tactical methods of fighting, and those who are to deal with the upkeep and maintenance of engineering and mechanical appliances which are necessitated by the complex machinery and weapons of modern war. Each side requires a special study, and for this reason final separation of the branches is essential." At the same time stress was laid on the importance of close co-operation between the deck and engineering branches. In its latest memorandum, the Admiralty summarizes the measures by which it proposes to effect this separation without prejudicing the high standard of efficiency that characterizes the *personnel* of each branch. So far as the deck side is concerned, the maintenance of such a standard may be said to be assured by the prospects of high command that lie before all officers who specialize in deck duties. On the engineering side, however, these attractions have not hitherto existed in equal measure; for, excepting the post of Engineer-in-Chief, and certain technical appointments, the higher offices open to engineers have been relatively few in number. As the Admiralty frankly recognizes, there is consequently "a danger that under existing conditions the engineering side may fail to attract its due proportion of officers of ability, and the service will suffer in efficiency accordingly." Among the several steps that are to be taken to avert this contingency, the first consists in raising the status and enlarging the province of the department of the Engineer-in-Chief. While this officer will continue, as at present, to be responsible for the design and supply of engineering material, and in this capacity remain subordinate to the Third Sea Lord and Controller, he is now to become principal adviser to the Chief of the Naval Staff on all matters concerning naval engineering policy. This means that in future he will work in intimate touch with the Naval Staff, and be closely informed as to the trend of naval policy, thus enabling him to frame his engineering plans to harmonize with the requirements of policy. Nor is this the only important extension that the duties of the Engineer-in-Chief are to undergo. Henceforth he will be the Board of Admiralty's principal adviser upon all questions relating to the teaching and training of engineering *personnel*, for which work he will be responsible to the Board through the Second Sea Lord. Owing to the new functions about to devolve upon it, the department of the Engineer-in-Chief will increase very considerably in size and importance, and thus provide scope for the appointment of senior engineer officers to posts of high administrative importance and responsibility. A further avenue of preferment is to be opened up by making engineer officers eligible to serve as Admiral Superin-

tendents of the Royal Dockyards. Until now these posts have been filled exclusively by deck officers, but under the new rule engineer officers who have attained the necessary rank are to enjoy an equal chance for such appointments, with the reservation that an engineer officer who may be serving as an Admiral Superintendent will not be eligible to command the port, since port command in war time deals with operations which are to remain the province of the deck officer alone.

To render more complete the separation of the two branches, the Admiralty has decided to cancel the rule under which lieutenants with a year's experience of watch-keeping to their credit before they specialized in engineering are allowed the option of reverting to deck duty between seven and a half and nine years' seniority. This modification is less drastic than might appear, since a very large majority of engineering specialists had already renounced the above option by accepting the Admiralty regulations promulgated in 1918—*vide* Monthly Order 4047 of that year—and the amendments notified in the following year. Of more importance is the impending decision of the board with respect to future responsibility for the maintenance of electrical machinery in H. M. ships. This responsibility rests at present upon the torpedo department, but a committee is now sitting to consider the question of transferring it to the engineering department. That this matter calls for careful investigation will be appreciated by all who are familiar with the multifarious duties—some directly bound up with the efficiency of the ship's torpedo armament, others bearing no direct relation to torpedo work proper—now discharged by the torpedo specialist and his staff. In our view, the transfer of many of these duties to the engineering department would be advantageous to the service by tending to simplify the organization on board and doing away with the overlapping of work which becomes inevitable under the arrangement now in force. At the same time, as the Admiralty memorandum points out, the change would open up further positions both in the junior and higher ranks to officers who have chosen an engineering career in the navy.

Taken as a whole, the reforms outlined in the memorandum impress us as representing a decided change for the better in the prospects of naval engineer officers. We especially welcome the improvement in the status of the Engineer-in-Chief and his department as a sign that the present board realizes more clearly than some of its predecessors did the vitally essential part that the engineer plays in modern naval organization. At no period in the history of naval development was there a greater need than exists to-day for the closest relationship between the Admiralty and its engineering advisers. Our future policy, as regards *matériel*, will be largely determined by the progress of engineering, with which only the specialist can keep fully abreast, and the fact that from now on the Engineer-in-Chief is to work in direct co-operation with the Naval Staff is an assurance that the British Navy will not lag behind its competitors in technical progress or technical efficiency. As for the separation of the two branches, deck and engineering, the majority of engineers, both within and without the service, will, we think, regard the Admiralty's decision as a sound one; but an examination of the principles on which it is based must be deferred to a subsequent occasion.—*The Engineer*, July 23, 1920.

NAVAL STAFFS AFLOAT.—It is interesting, as one of the signs of the influence of the war upon the internal economy of our ships, to notice the very large increase in the numbers of staff officers carried in flag-ships. If we go back 20 years, to the staff which was in the *Renown* when vice-Admiral Sir John Fisher, as he then was, flew his flag in her as Commander-in-Chief in the Mediterranean, it will be found that this numbered ten officers all told, including seven clerks. Fifteen years ago a staff of 13 was

all that Admiral Air Arthur Wilson had in the *Exmouth* when he was Commander-in-Chief of the Channel Fleet. At the present time, there are in the *Queen Elizabeth* 32 officers of all grades on the staff of the Commander-in-Chief of the Atlantic fleet; and the flagship in the Mediterranean, the *Iron Duke,* surpasses this with a total of 40 officers on the Commander-in-Chief's staff, although it seems fairly obvious that not all of them can be employed afloat. There are representatives on an Admiral's staff nowadays of every conceivable branch or duty, a fleet torpedo officer, gunnery officer, wireless officer, war staff officer, political officer, intelligence officer, signal officer, more than one engineer officer, a royal marine officer, accountant officer, and medical officer. A cynic of the old school of seamen might well ask what there is left for the Admiral to do. At any rate, it is a good thing that the size of ships continues to increase or there would not be room to stow away all the members of the staff.—*The Army & Navy Gazette,* July 24, 1920.

LIGHT CRUISER DESIGN.—With the recent launch of the *Emerald* on the Tyne, all the light cruisers ordered for the navy during the war have now been put afloat, with the one exception of the *Effingham* at Portsmouth. The *Emerald,* and her sistership the *Enterprise,* now at Devonport Dockyard awaiting completion, belong to a class which did not appear in any of the lists of ships during the war, and which it was thought had been abandoned after the armistice. The "E" type is, however, so much superior to the eight vessels of the "D" class that from the constructive point of view it is a good thing that two ships of the type should have been spared. The outstanding feature of the *Emerald* will be her speed—from 32 to 33 knots—which will make her quite the fastest cruiser ever designed for our navy, the previous limit of design being 30 knots. At this high rate, moreover, she will carry seven 6-inch guns, or one more than in the "D" class, and will be infinitely superior in armament to the *Arethusa,* with her mixed battery of two 6-inch and six 4-inch guns. As an engineering proposition the design of the *Emerald* must have presented many difficulties. Her tremendous drive of 80,000-horsepower exceeds that of all our battleships, and also of the battle cruiser *Lion;* in fact, only the later battle cruisers in the British, American and Japanese navies have a higher engine-power. For many reasons the design is most interesting, and although progress in construction seems likely to be slow, owing to the need for economy, the trials of such a vessel will be awaited with much keenness.—*The Army and Navy Gazette,* July 10, 1920.

THE SHIPBUILDING SITUATION.—It is becoming more and more evident that the peak of activity in the shipbuilding industry has been reached, both in this country and in the United States. Apart from special types of vessels, such as passenger steamers and ships for the carriage of oil in bulk, there is a very decided falling off in the number of new contracts being placed, and in fact some shipowners are endeavoring to get rid of their shipbuilding commitments. As regards oil-tank steamers, the demand is likely to continue longer owing to the enormous developments taking place in the use of oil fuel, which make it essential that the necessary transport shall be provided in spite of the present high costs. In the United States some alarm is being expressed at the great reduction of cargo-ship contracts reported, although a large increase in the number of oil-tanker contracts has taken place. The American shipbuilders realise that any special type of vessel alone will not enable them to keep their establishments employed for any prolonged period.

The causes of the reduced demand for new tonnage are self-evident. Apart from the falling freight market, the high cost of production and uncertain delivery now make the question of ordering a ship a very doubtful speculation, and with ever-advancing costs of labor and material the

risk involved is so great as to preclude business. One of the most important of the contributing factors to the period of reduced activity foreshadowed is the fact that, owing to the world's increased facilities for shipbuilding, the deficiency in tonnage is rapidly disappearing. Already there is considerably more tonnage afloat than just prior to the war, and it is calculated that at the end of the present year the tonnage in existence will be more than equal to the amount of the pre-war tonnage with the addition of the normal increase for the succeeding years. Mr. Lawrence D. Holt, of the well-known Liverpool shipping company, stated in a recent communication to the press that there was already too much tonnage in existence, but not enough British tonnage to maintain our position in the trading world, and that we must either launch more tonnage into a glutted market or surrender our position in the trading world.

This brings us to the question of cost of production, which is vital to the British shipbuilding industry for the future. The British shipowner will either not be able to compete with foreign owners if the British cost of production is higher than in other countries, or he will be compelled to contract abroad in order to maintain his position. The effect of foreign competition in shipbuilding before the war was becoming evident, and now, in addition, we have the agents of American shipyards in Europe actively competing with us. We have lost the advantage we possessed in our low cost of production, and the struggle for existence in the future is going to be a hard one, especially for the new shipyards which are just commencing operations and which have been laid out at a time of very high cost. Such profits as they will be able to retain after taxation while employment is yet good may possibly not enable them to lay aside reserves to tide over periods of little or no employment.

Ships now cost about four times as much to build as they did before the war, and prominent shipowners are of opinion that at this figure the economic limit at which it will be possible to make a shipping investment profitable in the future has been passed. It is of importance, therefore, to examine cost in relation to the main items of material and labor.

Steel, which is the most important material used in shipbuilding, at present costs four times what it did in 1910, the average price at present being about £25 per ton; and as there are large demands for steel apart from shipbuilding, it is possible that the price may be maintained at a high level in spite of a falling off in the demand for ships. In this respect, United States shipbuilders have now the advantage of cheaper and more abundant steel supplies, and this will be a material help to them in competition with this country. The price of steel is at too high a level, but it is difficult to foresee a reduction in view of the inordinate increase in the cost of fuel and the increased cost of transport. Nevertheless, it is imperatively necessary that there should be a reduction in the cost of steel if the British shipbuilding industry is not to suffer. The cost of ship production has also been greatly augmented by shortage of steel supplies, mainly due to congestion on the railways and the difficulty experienced in the past of obtaining coal for the steel works. This question of short supplies of steel has led to the acquisition of steel works by shipbuilding interests, especially in the Clyde area.

Labor costs in shipbuilding, due to shorter working hours and advances of wages, coupled with a reduction in output per man per hour, have increased out of proportion to the cost of living. Mr. D. B. Morison, chairman of Messrs. Richardsons, Westgarth & Company, Ltd., speaking at the last annual meeting of that company, stated that the actual time now taken to complete a given amount of work was on an average nearly half as long again as before the war. This reduced output, taken in conjunction with the wages' advances and reduction in hours, meant an increase in labor costs of about four times the pre-war figure. Mr. Morison's figures referred to marine engine-building and may be on the high side

so far as shipbuilding is concerned, but the labor cost in shipbuilding has increased at least three-fold.

In spite of the advantages already gained in the way of shorter working hours and increased wages, and encouraged by the facility with which advances have been conceded by the government during the war, and more recently, to other trades, the Federation of Engineering and Shipbuilding Trades has decided to apply for an advance of sixpence per hour, or 23s. 6d. per week, for adult workers, half this amount for boys under 18 years of age, and corresponding increases in piece-work rates. At the same time, the demand for a further reduction of hours to 44 per week is being pressed. The shipbuilding employers at the time of writing have given no indication of the attitude they will adopt with regard to these further demands when they are formally presented, but it is quite evident that neither the shipowning nor shipbuilding industries can stand such huge increases. If such concessions are made as the result of trade-union pressure, it is believed that the result will, in the end, lead to unemployment and prove disastrous. It will be in the best interests of the trade unions themselves if their new demands are declined. Advances of wages which entail still further increases in the cost of living, with the danger of unemployment, are of no benefit to the workers, but these elementary economic facts are recognized by only a handful of the trade-union leaders, whose views are not popular amongst the workmen. A concentrated demand that the cost of living be reduced with the active help of the trade unions, apart from resolutions to that effect which are valueless, would benefit the whole community, and place an international industry like shipbuilding in a stronger position to meet the world competition for work which is inevitable in the near future.—*The Shipbuilder*, July, 1920.

JAPAN

JAPANESE NAVAL PROGRESS.—From the recent debate in the Budget Committee of the Japanese House of Representatives it is possible to obtain a better idea of the program of naval construction which is now being proceeded with by our ally. The Minister for the Navy stated that the present budget includes provision for four dreadnaughts, four battle-cruisers and 12 destroyers and smaller craft. From this it would seem that the only fresh ships to be put in hand are two battle-cruisers. At the beginning of the present year there were already four battleships in hand. Since then the *Mutsu* has been put afloat—on May 31 last—and presumably one of the two projected battleships has been begun on the same slip. As regards battle-cruisers, however, only two were in the program, so that the mention of four during the debate on July 13 implies the authorization of two more. If this is so, it is highly significant that the Japanese should go in for more battle-cruisers in preference to battleships. One reason, however, may be that in 1916-17 an eight-year program was adopted which aimed at the provision of a standard fleet of eight battleships and eight battle-cruisers. At the moment, apart from the two already in hand, the only modern battle-cruisers possessed by Japan are the four of the *Kongo* class, so that two more are necessary to ensure the attainment of the proper standard. In this matter of naval expansion, the Japanese have been very candid; they have concealed nothing about their plans and intentions. A year ago when in London, Admiral Kato said that in Japan they would like to see a general agreement for disarmament, but they had formed no plans yet for a reduction of the navy or army; "we are waiting to see what is done in that way by the other great powers of the world." In the interval, Great Britain has been occupied in drastic reduction of her naval strength by the withdrawal of ships from commission, the sale of several classes of vessels and the dismantling of her naval bases. The same cannot be said of all the other sea powers. Hence the Japanese are

now going ahead with their 1916 plans, which they affirm are not directed against any potential enemy, but dictated by the country's insular position. In view of the renewal of the alliance between Great Britain and Japan, the recent decisions at Tokio are of special interest to this country.—*The Army & Navy Gazette*, July 24, 1920.

BRITAIN TOO PRO-AMERICAN TO SUIT JAPAN.—Grave doubts about the wisdom of continuing the Anglo-Japanese Alliance are expressed in some sections of the Japanese press, where it is felt that the mainspring for its existence no longer exists. Changes wrought by the world-war in the balance of powers and the prospective functioning of the League of Nations are given as reasons for surmises that the alliance has outlived the purpose which it served well. But more acrid criticism comes from those journals that charge Great Britain with having become too much influenced by America during the war and since. Then, too, Australia is accused of having become a political confidant of America because in California America has the same "white-man problem" as has Australia. Above all, resentment is expressed for a suspected interference on the part of America in the possible arrangements for the renewal of the pact. In sharp contrast to this insinuation is a statement of Marquis Okuma issued to the press in Japan in which he calls attention to the public interest the alliance has been eliciting in England, expresses himself in favor of its renewal, and says of America that—

"Because of the Monroe Doctrine, the United States may be unable actually to participate in the alliance to be concluded between Great Britain and Japan; but if such participation should be made possible or should be desired by the American people, America would surely be welcomed into the group so as to form a triple alliance and thus maintain the peace of the Orient with greater efficiency.

"Without the alliance, what about the future of India, and that of China, and that of Siberia? The fact is indisputable that for all the success the British Government has attained so far in the administration of India, there are many malcontents in that country. The fact should be particularly noted that the majority of the inhabitants of northern India are Mohammedans, who are as militaristic as they are religious. Since the fall of the Turkish Empire there has been increasing unrest among them. To make the situation worse, the Bolsheviki are now very active on the borders of both Turkestan and Afghanistan.

"At such a critical period as this nothing could have a worse influence on them than an impression that the Anglo-Japanese alliance is no more and that the Japanese would not interfere whatever might happen in India.

"The same theory may be applied to Japan as regards China and Siberia."

The Tokyo *Kokumin* recalls that when the first Anglo-Japanese Alliance was concluded it was published contrary to the international custom which had hitherto existed. It may be, therefore, that publicity will be given to the new terms if it is renewed, but this journal asserts:

"Other countries have no right to interfere in the negotiations for the renewal. Some Americans have urged that the Paris Conference should be opened to the public and that no secret diplomacy should be tolerated, but this is the twaddle of amateurs who know nothing about diplomacy. As a matter of fact, President Wilson and the diplomatic authorities of America are keeping all diplomatic affairs secret. Even the Anglo-French Alliance or the agreement between Great Britain, France, and America has been withheld from publicity, and this has caused considerable suspicion among the public. No secret treaty is permitted by the League of Nations covenant, but it does not object to the observance of secrecy regarding negotiations under way."

Australia is seen as a confidant of America by the Osaka *Asahi*, which says that the tendency for Australia to rely on America, which is in a position similar to her own, for the realization of her "white-Australia" principle has become clearer of late, and it recites that—

"During the five years of war Japan faithfully observed her obligations under the Anglo-Japanese Alliance, and the Japanese Navy maintained single-handed the safety of communication between Australia and India and Europe, but this has not allayed the Australian misgivings regarding Japan. It may be assumed that the majority of Australians hope for an alliance, or at least some special agreement, between Great Britain and America rather than for the continuance of the Anglo-Japanese Alliance.

"On the other hand, the British Government has become pro-American since the prosperity of Germany became a menace to Great Britain, and that tendency has become more glaring of late. The pro-Americanism of the British Government manifested itself in the conclusion of a treaty of arbitration with America at the time the Anglo-Japanese Alliance had been renewed for the third time. Subsequently the British Government recognized the Monroe Doctrine of America."

It need scarcely be pointed out that during the war and at the Peace Conference, the *Asahi* goes on to say, the British authorities "based their diplomatic policy on pro-Americanism," and it proceeds:

"At a time when there is such a strong pro-American feeling in Great Britain, it is unthinkable that the British Government should arrange for the renewal of the Anglo-Japanese Alliance without taking American wishes into consideration. It also goes without saying that Japanese and American interests are not all identical. . . . .

"In these days an alliance between two countries can not be concluded without the understanding and sympathy of the peoples. It is impossible to make an alliance really effective unless there is community of sentiment and interest between the two peoples, but in many respects there is no such mutuality between Great Britain and Japan. The continuance of the Anglo-Japanese Alliance is not wrong, but an alliance only on paper will lead to a situation similar to Italy's position with regard to the Triple Alliance."

Similarly minded, too, is the Tokyo *Yorodzu*, which admits that the establishment of the League of Nations necessitates modification of the Anglo-Japanese Alliance, but it calls attention to the fact that—

"Some British observers say that the stipulations in the alliance which relate to the territorial integrity of China and other Oriental questions should be extensively revised. If such is the opinion of the British Government, how can the maintenance of peace in the orient and India, which is the main purpose of the alliance, be insured? If the alliance is to be renewed, the renewal should be made in such a way that the document can serve the purpose of locally strengthening the validity of the League of Nations.

"If the British Government intends to reduce the scope of the alliance out of consideration for the sentiment of Australia and other colonies as well as of America, Great Britain should learn that it will be extremely difficult to renew the alliance. On the last occasion the document was renewed as the result of considerable concessions on Japan's part. What attitude will be assumed by the British Government this time? Japan's desire is to insure the peace of the Orient by renewing her alliance with Great Britain. If there is no hope of attaining that end, Japan had better leave everything to the League of Nations. Unless the British and the Japanese people heartily welcome the renewal of the alliance, the document will be merely an assurance on paper and will have no practical value. It is difficult for us to see how it can be advisable to maintain only the name of an alliance."

But the Tokyo *Yomiuri* points out that the fundamental object of the first alliance was to prepare against the southern advance of Russia, but that after the Russo-Japanese War a Russo-Japanese agreement was concluded with regard to South and North Manchuria and Inner and Outer Mongolia, while Great Britain concluded an agreement regarding the borders of India, such as Tibet and Persia. It was no longer necessary, therefore, to place India and Korea on the same footing, which was the primary object of the second alliance, and the *Yomiuri* proceeds:

"The only practical remaining value of the alliance lies in the promotion of common interests in China. Moreover, at the time of the conclusion of the third alliance the fundamental principle of excluding America from its stipulations was laid down. After the Russo-Japanese War, therefore, the Anglo-Japanese Alliance has long since lost the greater portion of its value without waiting for the collapse of Germany and Russia and the establishment of the League of Nations. If the value of the alliance is to be judged solely by its original functions in regard to Russia and by the consideration of the selfish interests of Japan and Great Britain, its necessity has long since disappeared, and there is no need to discuss the question as to whether it should be continued or not.

"Japan and Great Britain, representing the Orient and the Occident, together with America, form the mainstays of the world's peace, and in considering the question of the renewal of their alliance Japan and Great Britain should not confine their attention to the situation in regard to Russia and to their selfish interests alone. They should have a higher object and should be prepared to endeavor to promote the peace and happiness of the world."

As a matter of fact, an opportunity of serving some such purpose was given to the Anglo-Japanese Alliance during the war, this daily goes on to say, as it reminds us that Russia's defeat by Japan in 1905 led to the destruction of the balance of power and increased the influence and ambitions of Germany. Taking advantage of the benefits afforded by her alliance with Japan, Great Britain concentrated in the North Sea the main forces of her fleets from Chinese and Indian waters and in the Pacific, yet this was not sufficient to curb the ambitions of the Kaiser, and the result was the European War. We read then:

"Japan rose up in arms against Germany and rendered the Allies greater assistance than she was obliged to render by the Anglo-Japanese Alliance. While completely sweeping away German influence in the Orient, Japan made great efforts in the Pacific and the Mediterranean in the cause of the Allies. She took part in the Peace Conference, and, as one of the five great powers, she has contributed, together with her ally, to the promotion of the world's peace and the welfare of humanity. She is in a position to continue to render similar services through the League of Nations. Does this not mean that the Anglo-Japanese Alliance has led the two countries beyond the purview originally prescribed for it? If the Japanese and the British are aware of the importance of that point, it will not be difficult for them to overcome dissatisfaction due to selfish considerations, and, as a matter of fact, even dissatisfied observers do not object to the fundamental principle underlying the renewal of the alliance provided that some remedial amendments are made."

The Tokyo *Maiyu* echoes the latter suggestion and avers that it is becoming daily more clear that President Wilson's League of Nations is too "quixotic" to be realized at once, and adds:

"As a matter of fact, an alliance has been arranged between Great Britain, America, and France, and the idea that the League covenant makes all international agreements unnecessary is no longer tenable. The only question regarding the renewal of the Anglo-Japanese Alliance is as to how it should be modified."—*The Literary Digest*, July 17, 1920.

UNITED STATES

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, AS REPORTED JULY 31, 1920

Type, number and name	Contractor	Per cent of completion			
		Aug. 1, 1920		July 1, 1920	
		Total	On ship	Total	On ship
Battleships					
44 California	Mare Island Navy Yard	92.9	90.9	92.4	90.2
45 Colorado	New York S. B. Cpn.	55.2	46.3	51.1	40.8
46 Maryland	Newport News S. B. & D. D. Co.	77.7	25.9	76.	74.
47 Washington	New York S. B. Cpn.	48.9	37.8	47.8	35.8
48 West Virginia	Newport News S. B. & D. D. Co.	31.5	15.5	30.5	13.5
49 South Dakota	New York Navy Yard	13.3	5.5	12.5	5.
50 Indiana	New York Navy Yard	10.9	3.1	10.1	2.6
51 Montana	Mare Island Navy Yard	11.	3.4	10.9	2.9
52 North Carolina	Norfolk Navy Yard	14.1	7.9	12.5	6.5
53 Iowa	Newport News S. B. & D. D. Co.	4.5	3.5	4.5	2.
54 Massachusetts	Beth. S. B. Cpn. (Fore River)	....	....	....	.....
Battle Cruisers					
1 Lexington	Beth. S. B. Cpn. (Fore River)	.7	....	.6	.....
2 Constellation	Newport News S. B. & D. D. Co.	.7	....	.6	.....
3 Saratoga	New York S. B. Cpn.	.7	.2	.7	.2
4 Ranger	Newport News S. B. & D. D. Co.	.7	....	.6	.....
5 Constitution	Phila. Navy Yard	1.	.3	1.	.3
6 United States	Phila. Navy Yard	1.	.3	1.	.3
Scout Cruisers					
4	Todd D. D. & Const. Cpn.	58.5	4 .2	54.7	40.5
5	Todd D. D. & Const. Cpn.	51.3	36.5	49.9	30.5
6	Todd D. D. & Const. Cpn.	34.4	10.7	29.7	6.4
7	Beth. S. B. Cpn. (Fore River)	8.7	4.6	6.	2.9
8	Beth. S. B. Cpn. (Fore River)	8.7	4.6	6.	2.9
9	Wm. Cramp & Sons Co.	48.	....	45	.....
10	Wm. Cramp & Sons Co.	47.	....	43.	.....
11	Wm. Cramp & Sons Co.	20.	....	19.	.....
12	Wm. Cramp & Sons Co.	20.	....	19.	.....
13	Wm. Cramp & Sons Co.	20.	....	19.	.....
Miscellaneous					
Fuel Ship No. 17, Neches	Boston Navy Yard	88.9	87.8	84.	83.
Fuel Ship No. 18, Pecos	Boston Navy Yard	32.3	24 5	31.5	20.
Gunboat No. 21, Asheville	Charleston Navy Yard	Com.	7/6/20	99.8	99.8
Gunboat No. 22	Charleston Navy Yard	54.1	41.1	48.2	36.2
Hospital Ship No. 1, Relief	Phila. Navy Yard	94.	92.5	89 5	87.5
Amm. Ship No. 1, Pyro	Puget Sound Navy Yard	99.9	99.9	99.9	99.9
Amm. Ship No. 2, Nitro	Puget Sound Navy Yard	98.5	95.5	98.	94.
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	53.	43.	50.8	38.
Destroyer Tender No. 3, Dobbin	Phila. Navy Yard	27.2	26.	24.7	23.
Dest. Tender No. 4, Whitney	Boston Navy Yard	.5	.5	.....	.....
Sub. Tender No. 3, Holland	Puget Sound Navy Yard	5.	....	4.2	.....

In addition to the above there were 66 destroyers, 49 submarines, two tankers and four sea-going tugs under various stages of construction.

There were completed and delivered to the Navy Department during July, four destroyers, one submarine and one oil tanker.

Authorized but not under construction or contract 12 destroyers, seven submarines and one transport.

CIVILIANS AS NAVAL CHIEFS.—The American Press is already speculating on the changes in the Washington Cabinet that will take place as a result of the Presidential elections next November. As Mr. Wilson is not himself "running" for a third term, it is considered certain that all the most important posts in the government will be filled by new men, irrespective of whether the Democrats or the Republicans are successful at the polls. Among the Cabinet officials whose term of service is probably drawing to a close, Mr. Josephus Daniels is one of the best known. Since March, 1913, he has been Secretary of the Navy, and, whatever his critics may say, nothing can alter the fact that during the past seven years the United States Navy has undergone a phenomenal increase in size and power. At the present time it is much stronger, relatively and absolutely, than at any period of its history, not excepting the late 'sixties, when intensive shipbuilding during the Civil War had resulted in the creation of a huge but ephemeral fleet. The world-war was, of course, mainly responsible for the "national preparedness" movement which swept the states four or five years ago and culminated in the great three-year naval program passed in August, 1916. But it was due in no small measure to the zeal and shrewdness of Mr. Daniels that public support was gained for such an unprecedented bid for sea power. From a reputed pacificist and "Little Navyite" he became a most vigorous champion of sea armaments, so much so that until quite recently he was urging his compatriots to go on building battleships until they had made British supremacy a thing of the past. His latest program, it is true, did not find acceptance, but he has the satisfaction of knowing that the vessels authorized during his period of office will, when completed, make the United States battle fleet the strongest in the world.

But in spite of his undoubted service to the cause, Mr. Daniels has apparently failed to gain popularity in American naval circles, and the explanation is given by *The Scientific American* in the course of a recent article. However ignorant of technical matters a civilian Secretary of the navy may be at the date of his appointment, it would, our contemporary thinks, be impossible for him to discharge the duties of his office without gaining, as time goes by, a working knowledge of the complicated naval organization; and Mr. Daniels is no exception to the rule. But technical knowledge is not everything. Where the present Secretary is accused of having failed is in his inadequate appreciation of the high code of ethics which is instilled into young American naval officers at Annapolis, and fostered by service afloat or in the various duties and associations entailed in shore duty. "We are free to confess," says *The Scientific American*, "that the whole attitude of the Secretary during the recent Congressional investigation, in which so large a part of his effort was directed to personal attack upon what he conceived to be the idiosyncrasies of two of the most distinguished Admirals in the United States Navy, seems to show that he is as far from understanding the high character, lofty professional aspirations, and unselfish devotion of the officers of our navy to the service as he was when he first took up the office."

It is not for outsiders to comment upon this judgment in so far as it relates to a prominent American official, but our contemporary revives the old dispute as to whether the head of the navy should be a civilian or a naval officer, and that is a subject which has often been debated on this side, where the conditions, superficially different, are fundamentally the same. We are not surprised to find the journal in question taking the view that however desirable it might be, on technical grounds, to have a naval officer as Secretary—or First Lord, as the case may be—there are other and weightier reasons which make it necessary for the naval head to be a civilian. The same reasons apply with equal weight in this country, where it is now very rare to find any responsible critic who thinks the First Lord should be a naval officer. We quite agree, however, that more discrimination than is customary—either in Washington or London—

should be exercised in selecting civilians for this office. *The Scientific American* postulates as an essential qualification "a more than average knowledge of naval affairs, and preferably he (the candidate) should be a man who has acquired this knowledge as the result of a natural inborn interest in the subject." A case in point was that of the late Col. Roosevelt, whose enthusiasm for naval affairs antedates his appointment as Secretary of the Navy and made his administration exceptionally intelligent and purposeful. We must, however, admit that very few of our own First Lords have possessed this qualification. Here, as in America, the head of the navy is appointed more on the grounds of faithful political service to his party than for any technical knowledge that he may possess. But there is this important difference between the two systems, that whereas the First Lord rarely meddles with technical matters, and if he did would find himself resisted by the Sea Lords, whose resignation in a body could not fail to shake his own position, in America the Naval Secretary is virtually an autocrat, vested with supreme power over every branch of the navy and able to impose his own ideas on the service, however repugnant or contrary to practice and tradition they may be. We do not think there can be any question as to which of the two systems is the best or most consistent with the ideal of democratic government.—*The Naval and Military Record*, July 14, 1920.

AN ESTIMATE OF THE SITUATION.—Every time we construct a battleship, or give their well-deserved military rank to the corps of nurses; every time we increase the number of chaplains or the ammunition reserve for machine guns; every time we add to the number of hours devoted to vocational training; every time we require more carbon copies for the procurement of supplies, and every time we raise the limit of the number of men a captain should command—if he can get them—we make a military decision. And yet a military decision is worth nothing unless it is based upon an accurate estimate of the situation.

What I suggest may have been already done; but it does seem to me that our problems of planning would be enormously simplified, the efficiency of our military and naval establishments greatly increased, and their cost materially diminished, if every decision concerning them was based upon a considered estimate of the situation.

It does not seem to me that it would be a difficult paper to prepare by the planning groups of the army and navy acting in conjunction. It is true that the State Department would have to be consulted, and it is also true that the broad lines of such an estimate should be a matter of consideration by the Cabinet; but until this is done, there seems no insuperable objection to having it prepared by the appropriate bodies of the Army and Navy and having it signed by the Chief of Staff of the army and the Chief of the Bureau of Operations of the navy. In this form it would serve as a guide for all military decisions and recommendations by both. It would express the considered military judgment of the army and navy and yet could be overruled and departed from by higher authority.

As I see it, this paper would run about as follows:

Estimate of the Military Situation for the Two Years Beginning January 1, 1921.

"*Purpose:* To defend the United States and its possessions.

"*A.* Mandatories.

"*B.* Countries with which during the next two years we shall probably have such relations as may eventuate in war.

"*C.* Countries with which during the next two years we may have such relations as might eventuate in war.

"*D.* Countries with which during the next two years it is improbable that we shall have such relations as could eventuate in war.

"*A1.* Force required to execute our duty under mandates, given separately for each mandate. In this connection it may be noted that Cuba,

Haiti and San Domingo are essentially mandatories, although not under the League of Nations.

"*B*2. Force at the disposal of each of the countries under the *B* list.

"*B*3. Force required by us to hold in check and destroy such enemy force or combination of enemy forces which seem possible during the two-year period."

A copy of this paper would be sent by the Secretaries of War and of the Navy to each member of the Military and Naval Affairs Committees and of the Foreign Relations Committees of the Senate and House of Representatives.

Manifestly it would be a confidential document, but obviously it would not be highly inexpedient if its contents were divulged unofficially. It is not considered inexpedient for a city to be known to have a dependable police force, and I, for one, believe that, if Germany had known that Great Britain stood ready to intervene with her full power if the neutrality of Belgium were violated, there would probably have been no war of 1914.

It is quite true that the men who draw up such a paper can make no claim to omniscience, but they could certainly employ the same degree of foresight which is exhibited in the conduct of large business affairs, and planning for war has many of the requirements which control planning for a great engineering work. In our international relations we can certainly see fairly well two years ahead. It may be said that in 1913 it would have been inconceivable that in 1915 there would have been men in the United States who contemplated the possibility of sending American forces to France, and that accordingly such an estimate drawn up in 1913 would inevitably have been grossly in error. But would such an estimate, if drawn up in 1913, have been really in error? It is inconceivable that circumstances would have arisen requiring us to send an army to Enrope except to operate in conjunction with the armies of other countries for whom Germany would have been on the "B" list, so to speak, and whose military information concerning Germany would accordingly have been available to us the moment our relations grew strained.

The value of such an estimate as the basis of study and planning, if drawn up in 1915, is obvious.

Such a statement as I have suggested should manifestly be succint. For example, there is no room in it for details of army organization, and, furthermore, such details are not necessary. It would be possible to adopt units of comparison which would be sufficient for that purpose and which could be supplemented by further information if it were required. Such units could be gun power afloat and available during the two years covered, and the number of rifles which could be put into action. Gun power afloat carries with it auxiliary services, and so do rifles. If it were desired to go deeper into the matter, it would be perfectly possible to do so.

Such an official statement would give something definite to work upon. It would confine investigation, study and preparation to the assigned limits, and it would eliminate side shows which are always expensive and which, save in the minds of their proponents, have little military value. The purpose of an army and a navy is to fight. Everything else is subordinate to that and, being subordinate, can probably be dropped to advantage. After all, the United States as a going concern can only spend a certain amount of money for insurance. It has a right to know that this money is really being spent for insurance and that it assures.

Such a statement would introduce into military planning the question: "Why?" That question is a most important one in efficient administration. It requires that proposed expenditures should be for objects embraced in the considered scheme, and an estimate of the situation gives a means of ascertaining whether they do in fact have a place in that scheme.

Such a statement would be of great value in the hearings before congressional committees which are a part of our system of government. As it is now, they are apt to be conversations about a table, desultory, indefinite,

and long drawn out. With such an estimate before them, members of committees would be in the position of a board of directors questioning technical men upon a project. The army and navy witnesses would be in the position of agents selling protection, and they could be required to explain in detail just why and how any of their proposals meant protection. I do not see that the present method of committee hearings gives this information. It is true that there are many witnesses, but the testimony does not interlock and it is not correlated. With such a statement before them the members of the committee having hearings could ask "Why?" intelligently and judge whether the explanation was sufficient to warrant the expenditure.

Military establishments, like other governmental agencies, grow like trees, putting forth shoots and limbs. It is a sign of vigor that this should be so. Dead trees do not grow. But each governmental tree has its place in the park and cannot be allowed to crowd out its neighbors. Under our present system the trees interfere with each other, try to overshadow each other; each considers that it alone is entitled to soil and light and air. This means a gardener with a pruning knife and a plan of the garden. To-day we let the trees crowd each other until finally the gardener has to use an axe.

Although we are a warlike people we are not a military one. War has never been a primary industry of the United States. We wage war as a tremendous stunt. We like to improvise our military machine, use it with full vigor, then scrap it and turn to something else. Yet the only way to obtain rapid, efficient, and economical construction is slow and accurate preliminary planning. I think that such an estimate of the situation would be of material assistance in such planning.—*The Infantry Journal.*

MERCHANT MARINE

GOVERNMENT AND PRIVATE SHIPBUILDING DWINDLING.—Shipbuilding for both government and private account is now on a declining scale, says a statement just issued by the Atlantic Coast Shipbuilders' Association. Shipping Board construction has been dwindling from month to month for some time past, but June marked the first decrease in the amount of private tonnage under way. Practically no new orders are in sight and the prospects are that the great bulk of the work in hand will be completed by the end of the year.

Since the first of January the shrinkage in the work on hand in American yards has been nearly half a million gross tons. While private orders show an increase in this period of about 475,000 gross tons, this is offset by a loss of more than double that amount in the total of government construction under way. An analysis prepared by the Atlantic Coast Shipbuilders' Association from the records of the Shipping Board, the Department of Commerce, the American Bureau of Shipping and Lloyd's Register of Shipping shows that a year ago the Shipping Board alone had over a million gross tons more building than the board and private interests combined have to-day.

Private orders in hand in May showed an increase of 61,926 gross tons over the amount for the previous month, but the June total showed a decrease of 12,522 tons from the May figure. During June the Shipping Board laid only three new keels, representing 18,666 gross tons, as against deliveries for the month of 31 vessels aggregating 143,772 tons, reducing the total construction under way for the account of the government by 125,000 tons. As a result, building for private account is now 438,000 tons in excess of that for the Shipping Board, whereas at the first of the year government construction was nearly a million tons more than the total of private orders.

The high water mark for American shipyards was reached in March, 1919, when 3,733,000 gross tons were being built, in comparison with

2,469,000 tons at the present time. The latter figure compares with a total production of 4,318,000 gross tons last year, on which basis of output the work now in hand is sufficient to keep the yards employed only slightly more than six months. British shipyards at the beginning of April had 3,394,000 gross tons under way, almost a million tons more than the present total in this country.

Records covering the last nine months, prepared by the Association shows the fluctuations in volume of tonnage since the yards began to receive orders for private account on an appreciable scale. These show that the decline in government orders has been unbroken during this time and that the increases in private orders, after slowing down, have now become losses. The following table gives the construction under way, in gross tons, for both accounts:

1919	Shipping Board	Private orders	Govt. tonnage lead
October	2,600,146	347,343	2,252,803
November	2,300,380	550,714	1,749,666
December	2,095,308	805,147	1,290,161
1920			
January	1,975,000	977,488	997,512
February	1,829,284	1,256,573	572,711
March	1,629,288	1,337,445	291,783

1920	Shipping Board	Private orders	Private tonnage lead
April	1,311,623	1,404,198	92,575
May	1,140,683	1,466,624	325,941
June	1,015,577	1,454,102	438,525

The total tanker tonnage under construction increased slightly during June, but freights and other types of vessels under way decreased. Increases continue to be shown in the completions of ships in hand and further gains in this direction will add materially to the lessening of the volume of work, as new orders are not sufficient to bridge the gap. How the various kinds of vessels building for private account have varied in the period under review is shown as follows, in gross tons:

1919	Tankers	Freighters	Other types
October	74,437	235,523	37,383
November	214,940	295,493	40,281
December	369,084	400,556	35,507
1920			
January	476,742	470,197	30,549
February	588,565	620,567	47,441
March	722,549	561,455	53,441
April	745,140	623,917	35,641
May	807,325	619,890	39,409
June	812,325	602,853	38,924

It will be some time before the effect of the Merchant Marine Act of 1920 is felt, and in the meantime it seems apparent that shipbuilding activities are to be very considerably curtailed.—*The Nautical Gazette*, Aug. 7, 1920.

GROWTH OF AMERICAN SHIPPING.—On June 30, 1920, the close of the fiscal year, the shipping registered, enrolled, or licensed under the American flag, according to the official returns of the Bureau of Navigation, Department of Commerce, comprised 28,150 vessels of 16,350,000 gross tons. Final returns of smaller vessels built, lost, or abandoned will change

slightly these figures one way or the other, but probably not to the extent of 100 vessels and 12,000 gross tons. Since January 1, 1919, closely following the armistice of November 11, 1918, American shipping in round numbers has increased 5,000,000 gross tons, and during the fiscal year just ended the increase has been 3,400,000 gross tons, of which 3,100,000 gross tons are documented in the name of the government of the United States, represented by the Shipping Board. The table below shows the main features in the growth of American shipping since January 1, 1918.

The seagoing ships of 1000 gross tons or over by which our foreign trade and the more important branches of our coasting trade are conducted are separately stated. The striking feature is the growth of government ownership through the Shipping Board, based on the large appropriations by Congress for shipbuilding and operation to win the war. Such appropriations ceased with the fiscal year just ended, and further additions to the government's fleet will require sales from the present government fleet to private owners, so that the tonnage under government

Date	Seagoing of 1,000 gross tons and over				Seagoing and non-seagoing of 5 net tons and over, Shipping Board and private ownership.	
	Shipping Board vessels		Private ownership			
	Number	Gross tons	Number	Gross tons	Number	Gross tons
Jan. 1, 1918....	105	413,631	1,036	3,268,069	26,742	9,343,224
Jan. 1, 1919....	608	2,305,015	1,055	3,351,841	27,217	11,261,444
July 1, 1919....	982	3,827,203	1,076	3,472,819	27,513	12,907,300
Aug. 1, 1919...	1,083	4,251,788	1,068	3,453,603	.....	.....
Sept. 1, 1919...	1,170	4,621,502	1,075	3,478,506	.....	.....
Oct. 1, 1919....	1,255	4,984,583	1,079	3,502,512	28,045	14,173,337
Nov. 1, 1919...	1,355	5,397,369	1,076	3,494,494	.....	.....
Dec. 1, 1919...	1,420	5,686,906	1,101	3,571,064	.....	.....
Jan. 1, 1920....	1,465	5,940,742	1,119	3,648,018	28,338	15,239,288
Feb. 1, 1920...	1,505	6,129,924	1,136	3,704,170	.....	.....
Mar. 1, 1920...	1,516	6,248,851	1,153	3,742,682	.....	.....
Apr. 1, 1920 ...	1,539	6,402,647	1,166	3,790,585	28,058	15,720,744
May 1, 1920 ...	1,575	6,599,801	1,182	3,851,211	.....	.....
June 1, 1920...	1,610	6,801,536	1,191	3,879,489	.....	.....
July 1, 1920....	1,630	6,903,128	1,209	3,942,974	28,150	16,350,000

ownership is virtually at its maximum. The last two columns in the table give the quarterly returns for all documented shipping of the United States, including the seagoing ships in the first four columns.

American Documented Merchant Vessels.—The number and tonnage of American documented merchant vessels on specified dates are stated below:

The fleet of seagoing ships, each over 1000 gross tons, aggregating 2839 of 10,846,102 gross tons, consists of 2065 steel steamers of 9,270,418 gross tons and 377 wooden steamers of 933,424 gross tons (the small number of large motor ships being included with the steamers), and 99 steel sail vessels or schooner barges of 186,330 gross tons and 298 wooden sail vessels or schooner barges of 455,930 tons.

Seagoing vessels less than 1000 gross tons but over 500 gross tons not included in the table above number 565 of 432,639 gross tons. Including these smaller vessels, American tonnage on June 30, 1920, was distributed as to trade as follows: Registered for the foreign trade, 2541 ships of 9,531,190 gross tons; enrolled for the coasting trade by sea, 863 ships of 1,747,551 gross tons. The year's increase has been almost wholly in ships registered for foreign trade.—*The Nautical Gazette*, Aug. 7, 1920.

AMERICAN AND BRITISH SHIPBUILDING.—On another page will be found a summary of Lloyd's shipbuilding returns for the three months ending June 30. They show that as against an increase of 80,587 gross tons in the first quarter, the amount of new tonnage under construction in the world's shipyards (exclusive of those in Germany) declined 221,046 tons in the second quarter of this year. Eight countries report an increase in the amount of shipbuilding under way, while in eight others a decrease occurred. The total tonnage building on the first of this month was 7,720,904 tons. This is more than two and one-half times as much as was under way at the same date six years ago, when the corresponding figure was only 3,162,000 tons.

Our maximum shipbuilding effort was attained at the end of March, 1919, when the tonnage under construction in American and British yards footed up 4,185,523 and 2,254,845 tons respectively. We then led the United Kingdom by 1,930,678 tons. To-day the situation is completely reversed, Britain having 3,578,153 tons under construction as against 2,105,056 in this country. While there are only 366 steel steamers building in American as compared with 888 in British yards, those being turned out here average 5609 gross tons as against 4012 tons for the British vessels. We can therefore console ourselves with the fact that, although we are not building half as many steel craft as our British cousins, the average size of the vessels we are completing is one-third greater.

Up to this, Great Britain has shown a steady gain each quarter in the amount of tonnage under construction. The probabilities are, however, that new vessel construction in the United Kingdom has about attained its peak. The increase shown in the second quarter was only 183,728 tons as against one of 400,176 tons reported in the first quarter. As 72 contracts for new vessels to be built in British yards are said to have been cancelled in the single month of June, the chances would seem to favor a decline rather than a further increase in the amount of new tonnage under construction in the United Kingdom. It is a striking fact that, while the capacity of British yards has been enormously increased and many additional building berths laid out in them since 1914, their tonnage output has been about the same as in a normal period before the war. Thus new ships produced on the Clyde during the first half of this year aggregated 286,946 tons as against a corresponding output of 348,476 tons in the corresponding half of 1913. Shorter working hours and a lack of shipbuilding materials account for this disappointing showing. After all, it is not the tonnage under way, but the amount that is being sent into the water from month to month that counts. If the tonnage launched in the two countries during the last two quarters be taken as the true test, the showing of the United States will be found to be not nearly so far behind that of Britain as the figures of tonnage laid down would indicate.—*The Nautical Gazette*, July 31, 1920.

BENSON EXPLAINS SHIP PROBLEMS TO ADVERTISING MEN.—"I believe the problem is very largely yours," said Admiral Benson, chairman of the Shipping Board, on July 14, to a representative meeting of New York advertising men, when discussing the disposal of the Shipping Board's vessels.

Admiral Benson outlined the whole situation facing the Shipping Board. Figures bulked largely, although, like Mr. Lloyd George, he used them chiefly as adjectives to convey the immensity of the task before the country. He appealed to the advertising men to assist the Shipping Board in creating throughout the country a genuine interest in ships and shipping, and more specifically, in helping the board to dispose of the vast amount of tonnage still on its hands, not to speak of the large quantities of ship supplies still unsold.

It can be safely said that Admiral Benson made a very favorable impression by his natural manner and simple, sincere talk. He attempted no

tricks of oratory, but told a plain unvarnished tale. After 47 years of active service in the United States Navy he had, he said, earned his retirement and had only taken up his work with the Shipping Board as a patriotic duty. After his address he invited questions and many were asked. A strong defence was offered of the Hamburg-American and North German Lloyd deals.

Praises New Shipping Act.—The Admiral started out by praising warmly the new Merchant Marine Act. It was, he declared, one of the most constructive acts passed in many years by Congress. What was more, he added, it was passed almost unanimously. Some of its defects were due, not to the personal convictions of members, but to influences brought to bear on them from the outside.

It was a mistake, said the Admiral, to regard the Shipping Board as a necessary evil left over from the war and as something to be eliminated at the earliest possible moment. On the contrary, it was a permanent body created to last as long as the nation's shipping lasted. Its function was to render the same service to shipping as the Interstate Commerce Commission rendered to transportation on land. Personally, he thought the Shipping Board had performed a splendid service to the country. He had told Mr. Hurley that the way in which the latter had taken hold of the board's various enterprises marked him as a great man.

Among the interesting figures given by Admiral Benson and compiled up to June 30, 1920, were percentages of geographical allocation of Shipping Board tonnage, as follows: Northern Europe, 39 per cent; Southern Europe, 10 per cent; Transpacific, 16 per cent; South America, 11 per cent; Southern Europe, 10 per cent; West Indies and Caribbean, 9 per cent; Domestic 7 per cent; Africa, 3 per cent; between foreign ports, 3 per cent.

The distribution of Shipping Board vessels according to the ports they operate from was as follows: From North Atlantic ports, 615. Gulf ports, 184; in tramp service, 121; Pacific ports, 113; coastwise, 74; between foreign ports, 63; South Atlantic ports, 62. From New York there operate 273 Shipping Board steamers; from Norfolk, 133; from Baltimore, 101; from Philadelphia, 75; from Boston, 28, and from Portland, Me., 5.

"The war," said Admiral Benson, "has still left us one very strong competitor and one whose existence depends largely on the success of its merchant marine. But the percentage of our tonnage in relation to the necessities of our commerce is such that there should be no conflict of interest. We all know what it is that leads to trouble. It is selfishness and self-interest.

Deprecates International Irritation.—"In the attitude I take in pushing the merchant marine I want to shape things in such a way that there shall be no international irritation. All I wish to do is to defend our inalienable right as a great people. The new Merchant Marine Act contains only what is necessary for our national development and our commerce both foreign and domestic. But we should proceed with due regard to the necessities and feelings of our foreign competitors. We should enter into the thing in a spirit of friendly competition, with some feeling for the necessities of other nations. When all is said and done some of them are more dependent upon their commerce than we are, and we should give them due consideration. But under no circumstances should we allow anybody to dictate to us what our policy should be.

"The struggle is going to be keen and the fight severe, and we cannot succeed unless we have the united effort of the whole country. In my opinion we cannot succeed with ships owned and operated by the United States Government. Human nature is such that individual interest is necessary to success. A strong personal effort is needed. If you have the inexhaustible treasury of the United States behind you you will not work with the same effort and make the same sacrifice as if you were dependent on your own resources.

"I am not criticising those who are operating our ships, but it is a fact that somehow or another boats do stay longer in port than they should and more money is probably spent on repairs than would be the case if the ships were in private hands. For these reasons and for many others it is impossible in my opinion to have the United States properly and efficiently and indefinitely own and operate its merchant marine. To do so would, in my opinion, deaden business interest and initiative. As it is we are depending too much on other people doing the job for us.

"There is no intention to use Section 28, providing for discriminatory railroad rates, without due regard to our foreign competitors. It is not intended to apply the law brutally. Our idea is to make our competitors play the game fairly.

"So far, our sales policy has not been published, because we don't want to commit the incoming board, though I have no doubt it would be accepted if it were published. We will not sell any ship that is engaged in a successful trade route. It seems now as if South America and China were going to be our principal markets. I can say now that we do not intend to give the ships away at a ridiculous figure.

Hamburg-American Deal.—"Much has been said about the Hamburg-American proposition and the proposed arrangement with the North German Lloyd. We all have our opinion about the Hamburg-American Company before the war, but there is one thing beyond dispute: it was a successful business organization. The agreements which are being reached with the two German companies are strictly business propositons and not in any sense a love-feast.

"The situation was that if we had refused to enter into any agreement with the German companies our shipping would have suffered, because the Hamburg-American would have gone in with our competitors and would have obtained in that way the privileges they were seeking. In such a case we would have been in the position of having refused to co-operate and would have incurred a wide measure of hostility.

"In the case of the North German Lloyd it is simply a question of renting their docks and other terminal facilities. I am convinced that the companies making agreements with the Hamburg-American and the North German Lloyd are thoroughly American and that the propositions are good ones from an American standpoint. At least unless you can convince me that it is easier to climb over a fence than to go through a gate you cannot pursuade me that the propositions are not good. If we had not negotiated them we should have been in an impossible position."

As to the Leviathan.—In answer to a question about the *Leviathan*, Admiral Benson said the situation with regard to the big German liner was a very trying one. It was difficult, he said, for any one firm to raise the necessary funds to buy the vessel and recondition her with the money market in its present state. Personally he felt much inclined to accept the offer made for the *Leviathan* by the United States Mail Steamship Company. This offer was $3,000,000 stipulated on a Shipping Board loan of $6,000,000 for reconditioning purposes. Application of 25 per cent of the net earnings of the vessel for ten years was also a condition of the offer.

A questioner asked Admiral Benson what would happen to American ship-building if two years from now the price of tonnage in British yards were about $100 a ton and in American yards around $150. "I believe, that, if anything, it will be the other way round," was the Admiral's reply.—*The Nautical Gazette*, July 24, 1920.

COUNTER-ATTACK ON JONES BILL ADVOCATED.—In the face of the Jones Bill, our obvious duty is likewise to put ourselves into the position of the strong man armed, says the "Look Out Man" of London *Fairplay*. America may never need to use her weapon in such a way as to injure us; it is a certainty that there would be still less chance of her doing so if we were able to retaliate in kind. To-day she proposes to extend her

coastwise trading restrictions to her insular dominions, and, in effect, to subsidize her railways for the benefit of her mercantile marine. Whether Sir Eric Geddes has any similar plan in his head regarding our overseas and coasting trades I do not know; but, so far as our coastwise traffic is concerned—I use coastwise in the fullest Imperial sense, and as embracing all the British dominions—it is essential that we should take such steps that, should the operation of the Jones Bill be such as to cause unfair injury to our shipowners and merchants, we should be in a position immediately to put up a polite but effective counter-offensive.

We possess all the materials for the manufacture of a big club, for not only could we make ourselves self-supporting within the Empire, but many of our old-time customers could not do without us, and, in addition, our dominions have mercantile marines of their own capable of carrying the fight into those markets which might be lost to us were distance a factor in the situation. The question is: What steps do our government propose to take in the way of anticipating, let us say, the remote possibility of the Jones Bill being strictly interpreted and enforced? If our traders find themselves met by notices warning them to beware of spring guns and man traps in districts where hitherto they have been free to carry on business, they will naturally expect that, for their protection and for that of the nation generally, similar action will be taken along our own coast-lines. But, if that ever has to be done, we must have the means of doing it, and the United Kingdom must not do it off her own bat. An Imperial Conference should be called, the dominions' views should be taken, and a joint policy should be drawn up and published, so that no competitor would have any cause to feel aggrieved if it were suddenly found that Great Britain, for once, was prepared to do unto other as they sometimes have been a little overready to do unto her.—*The Nautical Gazette*, July 31, 1920.

AERONAUTICS

HELIUM PRODUCTION BY THE GOVERNMENT.—Fort Worth Tex.—It is authoritatively stated that the government will proceed with its original plans for the construction here of a helium production plant to cost approximately $5,000,000. The experimental plants for obtaining helium from the natural gas of the Petrolla field have been in successful operation at Fort Worth and Petrolla for more than two years.

Several months ago a Congressional committee made an adverse report on the construction of the proposed plant here on the ground that the cost of extracting helium was too heavy to make it a feasible enterprise. This report seems to have been of no effect, as contracts have just been let for enlargements of the initial plant here. The Reagan Construction Company of Baltimore, Md., has been awarded the contract for a gas storage house to be built of sheet steel, a water settling basin and a water supply system. The natural gas pipe line from Petrolla to Fort Worth, which was constructed by the government is practically finished. The contract has just been awarded for the construction of concrete gig boxes for the pipe line. It is expected that the big plant here will be finished and placed in full operation about October 1. The helium gas will be for the use of the army and navy, Lieut. Commander R. G. Walling, U. S. N., has been detailed in charge of the plant.—*The Aerial Age Weekly*.

FIFTEEN TORPEDO PLANES FOR U. S. NAVY.—Contracts have been let with the Stout Engineering Laboratories, Detroit, Mich., for six torpedo planes for the U. S. Navy. The Curtiss Engineering Corporation has been awarded the contract for nine torpedo planes.—*Aerial Age Weekly*, Aug. 2, 1920.

RECORD FLIGHT OF NAVY SEA PLANES.—Report has been filed with the Office of Operations, Navy Department, of a record flight made by three

F-5-L Navy seaplanes on the Pacific coast. Flying from San Francisco to San Diego without stop the seaplanes made the distance in six hours and forty-five minutes. On the return trip to San Francisco one of the planes was forced to land on the water because of motor trouble and was delayed twenty minutes, and then continued without stop. The entire trip was so highly successful that it is believed the *F-5-L* type seaplane can be used for photographing the entire California coast.—*Aerial Age Weekly*, Aug. 2, 1920.

THE GERMAN ALL-METAL AEROPLANES.—The first all-steel cantilever monoplane was produced by Junkers in December, 1915, after many model tests in his wind-tunnel at Aachen; it was equipped with a 120 h.p. Mercedes engine.

"Successful trial flights were made at Doberitz in January, 1916. As a result, the German Army gave him orders for armored aeroplanes, but compelled him to design them as biplanes. Various other Junkers all-metal monoplanes are shown in the photographs.

"The L. F. G. Roland seaplane works at Stralsund built an aluminum scout monoplane designed to stow on board a submarine when dismantled. This machine was fitted with a 110 h.p. Oberwesel engine, had a net weight of half-a-ton, and could carry a useful load of 189 kg. The wing area was 13 sq. m. and the span 10 m. The climb was 1000 m. in 9 minutes and 2000 m. in 21 minutes.

"Another machine was designed too late for the war, but has been produced since as a passenger carrier. It is a flying-boat of the wireless monoplane type, with rigid bracing. The pilot's cockpit with the passenger cabin behind it, is built on the front part of the hull, and the cabin structure extends up to the wing. The engine is mounted above the wing on an inverted vee-cabane. The planes are cut away for the pusher propeller. The engine is a 120 h.p. Mercedes, which is to be replaced by a 185 B.M.W. The speed is 140 km. p.h.; 110 litres of petrol are carried for a 3 hours' flight; the range at cruising speed is 520 km. Net weight 635 kg., gross, 1125 kg. Main dimensions: Span, 13½ m.; length, 8.33 m.; height, 2.82 m.

"The Staaken Works of the Zeppelin Company are at present engaged on the E-4-250a, a giant aluminium monoplane with four 260 h.p. Maybach engines mounted as tractors on the leading edge of the wing. Mechanics are accommodated in a lying position inside the aerofoil, and can attend to the engines in the air. The speed expected is 190 km. p.h. full out and 170 km. at three-quarters power. The surface loading is very high. There is accommodation for 18 passengers or 1 ton of paying load, and the range will be 1000 km. The machine can maintain flight in the air with only two engines running."—*The Technical Review*, July 20, 1920.

NAVY PLANES FOR SPOTTING FISH.—A regular fish patrol operating from the naval air station at Hampton Roads, Va., has been inaugurated, and each morning at 5 o'clock a flying boat carrying pilot, radio operator and fish spotter leaves the station to aid fishing craft. The grounds from Assateague to Currituck are covered and it is stated that fish have been sighted each day and fishing vessels directed to the schools. In two instances the fishing vessels were directed to large schools of menhaden and made record catches.—*The Aerial Age, Weekly*, July 19, 1920.

ENGINEERING

MOTORSHIP.—. . . . While the motorship as a successful and economic vessel in competition with steamships, is a reality, and has, therefore, passed through the first natural stage of any great development, it finds itself at the beginning of the second two stages, which are: First, public recognition of its value and second, rapid and large scale adoption.

No further demonstration of reliability or economy of the motorship in those branches of marine service to which it is adapted need be made, be-

yond the collection, classification and analysis of facts gathered from existing motorships now in operation, unless perhaps there may be added as further proof the list of large firms that have invested great sums of money in building or in preparation for the building of these vessels and their machinery, on the basis of their own convictions, so to be ready to meet the production demand that must inevitably follow the complete publicity of the demonstrated facts.

The fundamental element of the motorship, the element that is responsible for all of its characteristic economic qualities, is the Diesel oil engine which is used both for propelling the vessel in large units directly, and in small units also for driving electric generators, the current from which operates all auxiliary machinery. This type of internal combustion engine is now completing a period of 25 years of development for all purposes and, therefore, as such cannot be regarded as a novelty. In point of fuel consumption and efficiency, it is the most economical type engine known. As built for ship propulsion, it is usually provided with six cylinders, somewhat like the six cylinder automobile, but on an enormously larger scale, developing up to 500 horsepower per cylinder at low propeller speeds as a present high limit. It is direct connected to the propeller shaft, just like marine steam engines, and also like them, is reversible and capable of quite the same sort of maneuvering with starts, stops and reverses, as proper ship handling may require, using for this, compressed air produced by the small auxiliary engine. Like the more common automobile engines, it has the usual cam operated inlet and exhaust valves, but differs in certain important results. Instead of being water jacketed only around the cylinders and heads, its pistons are also jacketed because they are so large. Instead of attaching connecting rods to the pistons directly, these rods are pinned to crossheads, working on guides, and which in turn are connected to the pistons, by piston rods, a difference also due to the heavier parts, and conforming exactly to marine steam engine practice. Instead of drawing air inward through carburetors, air alone is drawn directly from the engine room into the cylinder, and compressed to a pressure of over 400 pounds per square inch. This makes the air practically red hot, and into this air a heavy fuel oil is injected for the first eighth of the out-stroke, the oil burning steadily as it enters, without any explosion.

These changes make the main parts of the motorship engine quite similar to the same parts of the old standard marine steam engines, and by suitably proportioning these parts an equal reliability in operation is assured for these parts including bedplates, frames, thrust blocks, crankshafts, connecting rods, crossheads and piston rods. Those features of the oil engine that differ from the old marine steam engine are connected with the control of fuel supply and its combustion, and these include the valve gear, fuel oil injection pumps, spray valves and compressed air for spraying, besides the cooling of the combustion chamber which is merely a matter of water jackets. All of these things are now fully developed to a degree of reliability quite equal to the other arts of the engine adopted from marine steam practice, and they are far more permanent than the equivalent steam boiler with oil or coal fired furnaces of the steam ship. In fact these special elements of the oil engine give no more operating trouble in the motorship than the corresponding elements of first class automobile engines which include the carburetor, ignition and water jacket system, but they have a longer life because of more liberal and conservative design, and better care by skilled engineers.

The mode of compressing air and injecting fuel into it for combustion, peculiar to the Diesel engine, is responsible for a very low fuel consumption, compared to automobile engines on the one hand, and also as compared to steam machinery on the other. This fuel oil consumption is equivalent to nearly 35 per cent thermal efficiency for the Diesel engine, the actual weight of oil consumed depending somewhat on its quality.

While satisfactory cooling conditions have been produced and are in use for engines of 3000 i. h. p. in six cylinders, the problem is more difficult

in larger cylinders, and development work on larger powers will not be seriously undertaken until the very large field that present sizes can meet is well filled. In twin engine ships this includes everything requiring 6000 h. p. or less, and in this range falls practically all cargo vessels as well as the smaller and slower passenger ships, and most, if not all, of the non-fighting ships of the navy.

A total of 2700 shaft horsepower would give a cargo vessel of 10,000 dead weight tons, a speed of 11 knots. At this power and speed a motor ship would burn for all purposes at sea about 13 tons of oil per day, against 35 tons for an economical oil burning steamship. The corresponding figures in port are .4 ton and 4.5 ton per day, for the motorship and steamship respectively. Therefore, the steamer consumes more fuel oil than the motorship at all times, eleven times as much in port and 2.6 times as much at sea.

This fuel oil saving of the motorship over the corresponding steamship is beyond question, though the difference may vary in numerical value with type and condition of the machinery of the steamer. It represents a yearly difference in dollars in favor of the motorship, which is larger, the higher the price of oil per barrel, and the more days per year, the ship remains at sea. Therefore, high fuel oil prices makes motorships more profitable than low prices compared with steamers, and it should be noted that the trend of oil prices is definitely upward. Very long voyages also favor the motorship, and its low fuel consumption makes it possible to carry enough for 20,000 miles in the double bottom.

The real value of a cargo ship is, however, measured by the total cost of its operation in terms of cost of carrying freight and this total cost includes certain fixed charges and depreciation, and certain operating charges, such as engine-room crew wages, repairs and overhaul, engine-room supplies, and insurance, all in addition to the fuel oil. While these terms must all be evaluated for each case under consideration, to arrive at a definite conclusion in the relative cost of operating steam and motorships, it may be said that excepting one item, the total of the rest will be substantially the same for both ships, or somewhat in favor of the motorship. This exception is the interest and depreciation on the capital investment, which, taken at equal rates, is always against the motorship.

It is estimated that these two types of vessels would cost: motorship—$1,950,000; steamship—$1,800,000, a difference against the motorship of $150,000. Charging interest and depreciation at 10 per cent, this imposes a yearly fixed charge of $15,000 per year against the motorship, which is neutralized when 5000 bbls. more oil are burned by the steamer than by the motorship at $3.00 per bbl. and all fuel burned in excess of this means clear gain. The steamship burns at sea 22 tons or 150 bbls. more oil per day than the motorship, so that only 33 days at sea are needed to equalize difference between fuel consumption costs and investment charges with oil at $3.00 per bbl. It is estimated that with due allowance for stays in port, an 11 knot motorship would be 133 days at sea per year between New York and Liverpool. New York to Buenos Aires 172 days at sea per year; New York to South Africa 307 days at sea per year. These figures show clearly that it would be easy for a motorship to neutralize its excess of yearly investment charges over the steamship by its low fuel consumption requiring a little more than one trip to Liverpool, less than one to Buenos Aires, and about half a trip to South Africa, with oil at $3.00 per bbl. The time would be shorter at higher fuel prices and longer at lower prices for oil than $3.00 per bbl.

The fuel economy of the motorship makes it cheaper to operate than the steamship in spite of greater investment charges, provided it is kept at work enough days per year for any given prevailing fuel oil prices, the total yearly cost differences depending mainly, though not exclusively on these two items of sea miles per year and fuel prices.

The lower yearly cost of motorship operation, compared with the steamship, is not the whole story, because there are some differences in cargo carrying capacity, in addition to very great differences in engine room working conditions which latter are decidedly in favor of motorships.

While the machinery weights for the steamer estimated at 550 tons are less than for the motorships, estimated at 630 tons, a difference of 80 tons in favor of the steamer, it must be remembered that the fuel consumption of the steamer is 2.6 times that of the motorship and the fuel weight in bunkers and tanks will more than neutralize this for trips of any considerable length. As an example, for a trip of 13,000 miles at 11 knots, the steamer will require 2100 tons of fuel, of which 1100 tons only may be carried on the double bottom bunker, so that 1000 tons must be carried in tanks. On the other hand, the motorship with the same 1100 tons in the double bottom cannot only complete the 13,000 miles without any extra tankage, but has still a margin of 7000 miles reserve capacity. This difference in fuel weight means an equivalent difference in cargo tonnage, though of course with very short trips this difference becomes less.

The situation as to bulk cargo is also favorable to the motorship, because in addition to the space occupied by extra fuel oil tanks required by the steamer, the motorship machinery space is usually shorter than for steam boiler and engine room; one estimate of this makes the space 58 ft. and 44 ft. long for the steam and motorships, leaving a margin of 14 ft. equivalent to 13,000 cu. ft. or 325 tons in favor of the motorship.

Complete absence of boiler rooms on the motorships as well as elimination of steam pipes in engine room makes the whole machinery space cool and comfortable, a matter of very great importance, especially in the tropics, because under these conditions, the engine room force can work in comfort, and better care of the machinery is sure to follow as a natural result of human nature.

Motorship construction was first undertaken seriously by the Scandinavians under the conviction that the new type of machinery could be made properly reliable, and that the savings to be expected in operation over steamships, was so great as to justify considerable expenditures for the necessary experimental and development work.

One of the first ship owning firms to act on this conviction was the Royal Dutch Petroleum Company. This company ordered its first Diesel ship in 1910, and at the beginning of the war they had thirteen (13) motor driven tankers in operation, all powered with Werkspoor engines. Their first vessel, the *Vulcanus* was the first ocean-going full-powered motorship ever built. Up to May, 1919, this vessel had covered 252,000 nautical miles and was still in satisfactory operation, notwithstanding the fact that her pioneer machinery is comparatively crude, judging by to-day's standard.

The Burnmeister and Wain Company, of Copenhagen, Denmark, has built to date 54 full-powered motorships with a total tonnage of 415,000, and a total power of 150,180 i. h. p. All of these vessels are now in operation.

The East Asiatic Co., of Copenhagen, Denmark, the pioneer company in the operation of large Diesel ocean going liners, once owned and operated 72,780 tons of steamships, but they have abandoned the use of these steam driven vessels in their oversea trade and are using motorships exclusively for this purpose. Mr. H. N. Anderson, managing director, cites as an example of the efficiency and reliability of this type of vessel the performance of the *Siam*, one of their 10,000 ton vessels, completed in 1913. The *Siam* sailed from Copenhagen to Japan and back on its first voyage, then across the Atlantic around Cape Horn to San Francisco, during which second voyage the motors ran 42 days and nights without stopping. From San Francisco she returned via Vladivostok and Suez to Copenhagen. The *Siam* is therefore the first motorship to circumnavigate the globe. In doing this she covered a total distance of 62,600 miles. This vessel has been in continuous operation since that time and is still in operation and performing very satisfactorily.

From the fact that the East Asiatic Company possesses a fleet of 15 motorships totalling about 120,000 tons, and had contracted for a further 250,000 tons up to 14,000 tons each, it is evident that the company has the greatest confidence in the motorship, and this is especially significant because of their original ownership of steamships.

The Rederiaktiebolaget Transatlantic Co. of Göteborg, Sweden, who own and operate the fine motorships *Bullaren* and *Tisnaren* are so pleased with their performance that they have prepared plans for converting their best steamship, the *Bolmen*, to Diesel motor power, at a cost exceeding the original investment. They have also contracted for five additional 12½ knot motorships of 9400 tons and one of 7500 tons, all to be completed before 1924.

The Grangesberg Co., of Stockholm, Sweden, has in operation or building 22 motorships aggregating 176,000 tons, and 57,200 i. h. p. (Trafikatiebolaget-Grangesberg-Oxelosund).

The Glen Line, Ltd. (Lord Pirrie's Co.), has eight ships afloat of 10,000 tons or over, with powers from 3100 i. h. p. to 6500 i. h. p. This company has a number of additional motorships on order including some of 13,000 tons, and 14 knots loaded sea speed.

There are now on order with shipbuilders in Holland for Norwegian owners, 14 ships of a total tonnage 75,500, and 35,350 i. h. p.

There are now being built in Italy 27 merchant motorships which will be fitted with engines, ranging from 300 to 2200 b. h. p.

Every shipbuilding nation in Europe is now building motorships. In many cases there are more motorships under construction than steamships and some yards build motorships exclusively. The motorship is most appreciated by its owners and most of the new construction is on repeat orders, though recruits are recorded regularly both among ship owners and operators ordering new motorships in place of steamships, and among ships and engine builders announcing their readiness to take and execute orders.

Thus, in but little more than ten years the motorship has emerged from the stage of hope and promise to that of commercial reality, and a new phase of the industrial revolution of the internal combustion engine has become a fact. The supremacy of steam at sea has passed never to return so long as a supply of liquid fuel is available.

The whole of this motorship development has taken place in Europe, and America has done nothing; nothing but continue to build steamships to compete with the more economical European motorships. America, the land of oil, and world leader in the production of motor cars, is only now beginning to realize that the motorship has arrived. While the American public is as yet but ill informed as to these facts, those interests most concerned, have accepted them and are acting on the conviction that motorship construction must now be undertaken by us, and that once seriously started, motor car history will be repeated by transferring the center of activity from Europe to America.

Large investments are now being made here in preparation for the handling of the large volume of business sure to follow public familiarity with the facts. In most cases these American firms are provided with European drawings and data and will reproduce European practice in their construction of motorship machinery, but one of these firms, Worthington, has taken the step of producing main and auxiliary machinery of its own design. The American Bureau of Shipping accepts the motorship as an insurance risk on the same basis as the steamship, and has issued similar rules for controlling safe constructions in the interest of owners and insurers. The United States Board of Steamboat Inspectors charged by law with the duty of establishing standard of competence of engineers in charge of the machinery at sea, and the issue of licenses to qualified persons, is fully alive to the situation and having accepted the motorship as a reality, is making plans to assure owners that their engineers are safe men. Schools

for training candidates for motorship engineers' licenses are being established and the better living conditions are attracting old steamship engineers to the new service. For proper publicity of motorship information all marine journals are giving increasing space to the new subject, but one journal "Motorship" devotes itself exclusively to this subject.

It would therefore seem as if the motorship was about to enter the last of the three stages of all development, following demonstration of reliability and economic value and acceptance of the facts by the special interests concerned, and that complete publicity of the situation must inaugurate a program of really large scale production and general use.—Dr. Chas. E. Lucke, *The National Marine*, June, 1920.

ALTERNATING CURRENT COMMUTATING MOTORS.—The early stages in the development of the alternating current commutator motor were hampered by difficulties in obtaining sparkless operation.

The problem of commutation was not sufficiently understood, and it was usual to consider it as fundamentally different from that of direct current commutation. It is now perceived that commutation in each class of motor is of the same nature, and that the difference is largely a matter of the values of the electromotive force short-circuited by the brushes. In the alternating current motor, as in the direct current motor, the short-circuited electromotive force is due to fluxes due to the amature magneto-motive force, but, in addition to these, there are introduced additional fluxes that are superposed on the ones just referred to, and complicate the problem.

The major part of the present article is concerned with a consideration of the different elctromotive forces that should be taken into account with various types of alternating current motors, and it is shown that the electromotive forces involved in speed control also have an influence on the commutation problem.

The paper concludes with a treatment of the general conditions of brush operation and commutation, and a comparison of the commutation limits for alternating current and direct current motors as given in the following table of limiting short-circuited electromotive forces for three types of loading:

(a) Load permitting continuous operation without undue deterioration of the commutator and brushes.

(b) One-hour loads followed by a period of lighter operation.

(c) Momentary or very short period load which would be quite destructive if continued for any considerable length of time.

Type of apparatus	Effective e. m. f. Shortcircuited		
	Load (a)	Load (b)	Load (c)
D-C. non-commutating pole traction motor (average of 9 sizes).	5 to 7	9 to 11	14 to 17
D-C. engine type Generators (non-commutating pole).	5 to 6	7 to 10	.....
Special d-c. 3rd-brush motor—200 h. p.....	5 to 6	.....	.....
A-C. traction motors—doubly-fed and commutating pole types.	5 to 6	.....	12 to 14
A-C. traction motors—resistance lead, non-commutating pole types.	7.5 to 9	9 to 11.5	13 to 15
A-C. industrial motors.....	5 to 6.5	.....	.....
Frequency changers.....	5 to 6.5	8 to 10	.....

(B. G. Lamme, *American Institute of Electrical Engineers, Journal*, Mar., 1920. 36 cols., 22 figs.).—*The Technical Review*, July 20, 1920.

SUBMARINE DETECTION IN AN ALTERNATING MAGNETIC FIELD.—The experiments described relate to the detection of submarines by their distorting effect on an alternating magnetic field set up by apparatus carried on a searching vessel.

"An alternating magnetic field is set up by a straight bar magnet with an open magnetic circuit. In the field of this magnet, and as far away as is practicable, is located a detecting coil with its plane parallel to the lines of force (in which case the magnet induces no voltage in the coil), or not parallel to the lines of force (in which case the induced voltage must be balanced out by a compensating field). In either case, the approach of a submarine will distort the alternating field, so as to cause a voltage to be induced in the search coil, which is detected by a suitable instrument. The signal will vary roughly inversely as the sixth power of the distance to the submarine, and so very sensitive detectors are required. This quality is possessed by three-electrode amplifiers.

"The first tests were made on model submarines 10 ft. long and 1 ft. in diameter, mounted on trucks, and the main difficulties consisted in balancing out the induced voltage in the search coil in phase and magnitude, the difficulty increasing as the amplification of the detecting apparatus was increased. Without amplification the detection was certain at 10 ft. distance, and this was increased to 50 ft. by using three stages of amplification.

"Further tests were made on full size steel hulls, and detection was found to be possible at 450 ft. distance with apparatus mounted on a pier head. With the apparatus mounted in a wooden submarine chaser 110 ft. long the limitations of power available and space for setting up the apparatus reduced the distance of detection to 200 ft. in smooth water.

"The generator had a capacity of 3½ k. w., and precautions had to be taken to eliminate the distortion of field produced by the steel bulk-heads. The alternating current magnet was 9 ft. long and had a cross section of 7.7 sq. in., and was placed just abaft the pilot house. The detecting and balancing coils were situated in the forward hold and in the wireless room respectively. All the wiring was enclosed in steel tubing in order to screen it. The motion of the boat introduced such disturbance in the magnetic balance that the sensitivity of the detecting apparatus had to be reduced to from one-half to one-tenth of the value used in the shore tests. (J. B. Whitehead and L. O. Grondahl, *American Institute of Electrical Engineers, Journal*, Mar., 1920. 22 cols., 5 figs. *The Technical Review*, July 6, 1920.

RADIO

RADIO WARNS MAIL PLANE.—Washington.—A practical demonstration of the value of wireless communication with commercial aeroplanes during flights was recently made in the operation of the regular mail plane between Cleveland and Chicago.

This aeroplane, a large Martin twin motor machine, left Cleveland under perfect weather conditions about 3 o'clock in the afternoon with the mail for Chicago. The wireless operator was in touch with various stations within a range of 100 miles. In the course of the flight the Cleveland station picked up the plane by wireless and transmitted a storm warning from the lower lakes for the aerial mail pilot. The radio operator at once got in touch with navy stations for further details as to the velocity and direction of the wind in the approaching storm, with the result that the plane landed at the emergency aerial mail station at Bryan, Ohio, where additional gas and oil were taken to meet the approaching head winds. The plane, being so reserviced, proceeded to Chicago and within an hour ran into a thunderstorm.

The radio operator reported that the lightning discharges were so near the plane that the amplifier of the radio set was paralyzed and that he was obliged to remove the radio helmet from his head. The antennæ absorbed

an electric charge while passing through clouds, shocking the operator. He pulled in the antennæ, until the storm had passed.

By this time darkness had set in and the pilot and the plane had an S. O. S. call sent to the stations surrounding Chicago, asking the field manager to set flares and turn on the flood lights to allow a landing in the dark. Seven amateur and regular radio stations responded, with the result that with this assistance the field was lighted.

It is the opinion of the post office authorities that this single instance in the use of radio in the mail work saved costly damage to a $40,000 aeroplane and possible injury to men which would have resulted from a crash in the dark.—*The Aerial Age Weekly*, July 12, 1920.

MISCELLANEOUS

THE NEW INSTRUCTION ORDER AND PERSONAL INITIATIVE.—By the time this Journal appears, all officers in the coast defenses and regiments will have received copies of the new Instruction Order, entitled, "Instruction of Coast Artillery Troops," which supercedes Special Regulations No. 22. It it believed the thoughtful officer will be impressed with what this order does not contain, as well as with what it does contain. The change in extent to which the details of instruction, target practice, inspections, and every other form of activity, are described from the manner of handling all of these subjects in every instruction order we have before known, is significant of the trend of the times in our army. The gist of the idea which can be read from this whole order may be drawn from paragraph 11.

"11. It is expected that Coast Artillery district and brigade commanders will exercise fully their initiative in and responsibility for the methods of instruction and target practice. However, it is desired to point out that the value of firing problems depends upon the nearness of their approach to service conditions and upon the training in gunnery which they afford. All service conditions need not be assumed to exist simultaneously; that is, the practice may have for its object the solution of the battery, battalion, fire, or fort command problem during some one particular phase to be anticipated under service conditions. From time to time the Chief of Coast Artillery, in training memoranda, will publish to the Coast Artillery suggestions as to firing problems, methods of conducting fire, and extracts from target practice reports."

The purpose is obvious, to develop initiative and increase individual responsibility. Every officer, from brigade and district commanders down, is presumed, under this Instruction Order, to be seeking the most effective results and to be conscientious in his own effort. It is up to us to demonstrate that this confidence is justified.

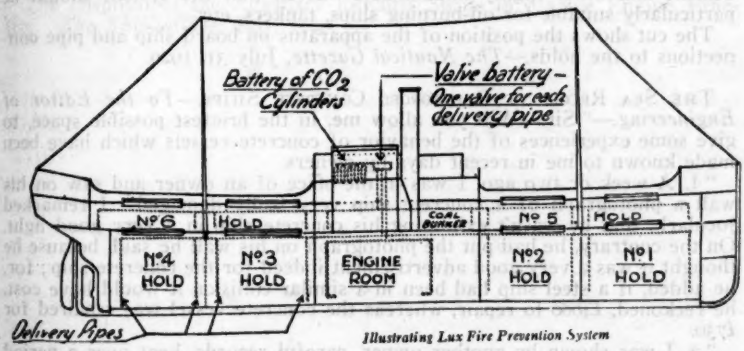
We miss the Figure of Merit, but we shall not regret its departure. The end now to be attained is, frankly, the development of methods which will promise effective sustained fire. With the elimination of the Figure of Merit from our concern, we are no longer compelled to smother our convictions in details of training and fire control, for the sake of trying to obtain the specious advantage of a Figure of Merit, which, however many factors and symbols it might contain, could never give a true measure of the efficiency of a battery or a battery commander, especially with as limited an ammunition allowance as will always prevail for our large caliber guns.

Personally we are delighted to see the emphasis placed upon Analysis and Analysis Boards. If analysis of practice has some times in the past been our bugbear, perhaps it has so been because of our failure to grasp the advantages of a proper use of analysis and because of a lack of prevision in preparing for it. All of us should prepare for analysis at practice by instituting analysis at drill. All of the data necessary for complete analysis of firing can be kept without confusion or worry on the part of any of the personnel assigned to a battery, provided the process is not interjected into the strenuous period of firing itself as a new and extraneous burden

imposed upon officers and men. The keeping of the data for analysis should be recognized as a part of a routine drill as much as receiving the meteorological message or transmitting data to the guns. The value of such a policy lies not only in the resulting freedom from confusion at the time of firing, but as well it enables the battery commander to analyze the work of each important member of his fire control section, so that day by day he can determine what mistakes each man makes and how many, and how to help them to eliminate the errors which, if undetected at drill, will be incorporated in the results of firing.

When we come to shoot, we will be able to appreciate to what a marked extent the latitude permitted by this latest order will have encouraged progressive effort and the development of original ideas.—*The Journal U. S. Artillery*, July, 1920.

LUX FIRE PREVENTION SERVICE.—A new system of extinguishing fires on board ships has lately been introduced into England, which method has met with considerable success in other countries, notably Norway and Sweden, and has the approval of the Norwegian and Swedish insurance companies,



Illustrating Lux Fire Prevention System

according to a foreign contemporary. The majority of the largest lines in these countries having already installed plants in their steamers and extracts from logs of ships in which fires have occurred show the successful working of the apparatus.

The patent is originally Swedish, being owned by the Aktiebolaget Lux of Stockholm, but licenses have been granted in most European countries; a description of the method of working of the system may, therefore, be of interest.

The system is based on the use of carbonic acid. This gas will, as is well known, extinguish fire by preventing the supply of oxygen, and has previously been used for this purpose in various ways, also in the liquid form, as is the case here, but the new method, it is claimed, has several advantages over those hitherto used.

In the "Lux" system the necessary quantity of carbonic acid is kept permanently in a liquid state under high pressure in ordinary steel gas-cylinders, which are preferably placed in the upper part of the ship. From these containers pipes lead under the deck to the various holds, branch connections being led down at suitable intervals close to the bottom of the holds. On the outbreak of fire the officer on duty turns on a valve, thus releasing the carbonic acid, and allowing it to pass to the pipe which leads to that part of the ship desired. The carbonic acid under high pressure immediately escapes into the hold and extinguishes the fire. The essentially new point in using liquid carbonic acid by the "Lux" system is, that it flows

from the containers to the fire in a liquid form. The following advantages are stated to be thus obtained:

1. The pipes can be made of as small a diameter as ½ inch and can be conveniently and securely placed along beams, joists or pillars.

2. The carbonic acid is immediately brought to the place where it is to be applied, by the pressure in the containers alone.

3. On its release from pressure the carbonic acid evaporates from the liquid to the gas form, thereby causing a tremendous drop in temperature in the room where fire has broken out. This is a point of great importance, as the cooling effect has the result of preventing a recurrence of the fire when the hatches are opened up later for inspection.

In comparison with water or steam, carbonic acid has great advantage as a fire extinguisher. Most kinds of cargo are destroyed by water or steam and in the case of a cargo of coal, as is well known, the pouring on of water or steam may increase the fire or even form explosive mixtures. On the other hand, carbonic acid is perfectly harmless to practically every class of cargo.

Carbonic acid has also the property of extinguishing burning petrol, benzine and other highly inflammable oils so that the system should be particularly suitable for oil-burning ships, tankers, etc.

The cut shows the position of the apparatus on board ship and pipe connections to the holds.—*The Nautical Gazette*, July 31, 1920.

THE SEA RECORD OF REINFORCED CONCRETE SHIPS.—*To the Editor of Engineering.*—"Sir.—Will you allow me, in the briefest possible space, to give some experiences of the behavior of concrete-vessels which have been made known to me in recent days by owners.

"1. A week or two ago, I was in the office of an owner and saw on his wall a photograph of a concrete ship very badly damaged. I remarked jocularly that he wasn't exhibiting his concrete ship in a very good light. On the contrary, he had put the photograph on his wall he said, because he thought it was a very good advertisement indeed for the concrete ship; for, he added, if a steel ship had been in a similar collision it would have cost, he reckoned, £4000 to repair, whereas the concrete vessel was repaired for £750.

"2. I was shown by another owner, careful records, kept over a period of six months, of the upkeep costs of steel and concrete steamers of the same size and in the same trade, and working under the same conditions. *The concrete vessels cost one-fifth of the upkeep of steel vessels.*

"3. I have a copy of a letter written by the skipper of a concrete vessel to the builder: "We left Swansea in a gale, when steamers would not sail, and for 24 hours, till we got to the Lizard, we had terrible weather; the puddling fenders and a few more things were missing in the morning but the ship stuck it well.

"4. I have before me a letter from the managers of an American, 3500-ton concrete freighter who gave an extract from the log of their captain who made a special report on the vessel's performance between a Chilian port and the States: 'We ran into a gale from NE. with a velocity of around 65 m.p.h., on December 10, which lasted until December 12. During this gale there was a high sea running, and I must say I never in all my seagoing saw a ship act as gracefully and well. At times, large seas came at her looking as if they would come aboard, and the ship would rise every time, proving she had a great amount of buoyancy. I tried her in the trough and she rolled very easily.'"—*Engineering*, July 9, 1920.

CURRENT AND NAVAL PROFESSIONAL PAPERS

The White Oil Fuel System as Applied to the Cunard Liners *Aquitania* and *Olympic*. *Engineering*, July 2, 1920.

The Packard Aero Engine Type 2025. *Aerial Age Weekly*, July 19, 1920.

The Audion—Its Actions and Some Recent Applications. By Lee De Forest. *The Journal of the Franklin Institute*, July, 1920.

Tests on Auxiliary Condensers (Great Britain). *Engineering and Industrial Management*, July 1, 1920.

Trend of Thought in French Military Circles—The Cavalry—(Translation.) *The Cavalry Journal*, July, 1920.

The International Aero Exhibition. *Engineering*, July 16, *et seq.*

Some Experimental work in Connection with Diesel Engines. *Engineering*, July 23, *et seq.*

Practical Personnel Management. *Industrial Management*, August, 1920.

The Design and Construction of Mercantile Vessels in the Light of War Experiences. *Engineering*, July 9, 1920.

The Manufacture of High Grade Steel—Acid Open Hearth Process. *Engineering and Industrial Management*, July 22, 1920.

Testing Ventilating Appliances on Shipboard. *Engineering and Industrial Management*, July 22, 1920.

For Sale—The Panama Canal. *Sea Power*, July, 1920.

The Disposal of the Auxiliary Exhaust Steam in Marine Engine Practice. *The Shipbuilder*, July, 1920.

NOTES ON INTERNATIONAL AFFAIRS

FROM JULY 10 TO AUGUST 10

PREPARED BY

ALLAN WESTCOTT, Professor, U. S. Naval Academy

RESULTS OF SPA CONFERENCE

The Allied-German Conference at Spa closed on July 16. The German delegates after bitter opposition finally agreed to the Allied demand for the delivery of two million tons of coal a month for the next six months, Germany, however, receiving a credit which is likely to amount to 100 million dollars by virtue of the increased price of coal since the Versailles Treaty.

The reparations question was left for final settlement in the hands of a commission of experts from the Allied Powers and Germany. The Allies adhered to their threat to occupy the Ruhr Valley or other German territory in the event of non-fulfilment of the treaty terms.

THE POLISH-RUSSIAN CRISIS

POLAND SEEKS TERMS.—Placed in a critical situation by the Russian advance on Warsaw, Poland on July 22 sent an armistice proposal direct to the Moscow Government, at the same time reorganizing the Polish cabinet so as to secure Socialist support. In reply the Soviet Government agreed to negotiations, but at the first conference on July 30 no understanding was reached owing to the inability of the Polish delegates to act definitely without consulting their government.

The Russians continued their offensive during the armistice discussion, and on August 8 were bombarding the outer forts of Warsaw. Poland sent a second peace delegation with fuller credentials, and it was arranged that this delegation should enter the Russian lines on August 9 and begin armistice and peace negotiations at Minsk on August 11.

According to a statement issued by the Russian delegation in London on August 8, Russia was willing to accept the 1918 frontier established at Versailles. The delegation had received the following message from Moscow:

"Resultant on acceptance by Poland of the armistice terms, which will deal principally with reduction of her armed strength, the Soviet republic will be prepared to begin withdrawal of her troops to the line drawn by the supreme council in 1918 and indicated again by Earl Curzon (British secretary of state for foreign affairs) in his note of July 20 to Tchitcherin (Bolshevist foreign minister)."

ALLIED LIMITATIONS ON RUSSIAN DEMANDS.—Paris, July 30.—The limitations which Great Britain and France would put upon Soviet demands of

Poland in the arranging of an armistice are set forth in a notification which has been dispatched to the Warsaw Government by the British and French governments, it was learned here to-day. Poland requested the views of Great Britain and France on possible armistice terms, and the governments at London and Paris have notified the Polish Government that they will not permit Poland to accept possible Soviet armistice demands involving:

First—Whole or partial disarmament of Poland.

Second—A change in the Polish system of government dictated or brought about by the Soviets.

Third—Acceptance by Poland of a boundary line less favorable than that provisionally drawn by Premier Lloyd George.

Fourth—The use of Poland as a bridgehead, in any sense, between Germany and Russia.—*N. Y. Times,* January, 8.

ALLIED POWERS TO AID POLAND.—Following extended negotiations in an effort to mediate between Poland and Soviet Russia by means of a peace conference to be held in London, the Allied ministers met at Boulogne on August 8 to consider the question of direct aid for Poland, Prior to that date, on August 6, Premier Lloyd George proposed to Russia a 10-day truce on the following terms:

First.—The Poles to refrain from re-equipping their armies and moving troops and munitions and the Soviet to refrain from strengthening their front.

Second.—The Allies to refrain from sending troops or munitions to Poland.

Third.—Soviet representatives to be stationed at Danzig or any other point to see that the terms were carried out, on the condition that they refrain from propaganda.

Fourth.—The Russian and Polish delegates to meet to define lines between the armies and to arrange armistice conditions.

These terms the Soviets rejected, and the crisis thus created was regarded in French and British circles as second in gravity only to that of 1914. While no official declaration of war was contemplated, the Allies were resolved to give Poland all possible military, naval, and economic aid without delay.

LEAGUE OF NATIONS

LEAGUE ASSEMBLY TO MEET AT GENEVA.—Washington, July 15.—President Wilson has issued a call for a meeting of the Assembly of the League of Nations at Geneva, Switzerland, on November 15.

The call issued by the President has been sent to all nations which are members of the League, each of which will be entitled to representation in the Assembly.

The President's decision in favor of Geneva as the initial meeting place not only means that the first sessions will take place on neutral soil, but that the President has again indicated his disapproval of Brussels as the place for the permanent seat of the League. It will be recollected that the Allied Powers were at first in favor of the selection of the Belgian capital.

INQUIRY REGARDING ANGLO-FRENCH OIL PACT.—At the close of July the United States Department of State issued a notice regarding its attitude toward the recent agreement between Great Britain and France for the development and distribution of oil interests in mandate territories of the

two powers. Inquiries were made by the United States Government as to the character and scope of the agreement. The statement follows:

"The Department of State has received information that an Anglo-French petroleum agreement has been published by the British Government. The department has made representations to the British Government regarding certain provisions that apply to petroleum in mandate territories and is giving careful consideration to other features of the agreement."

In general the agreement provides that there shall be co-operation between Great Britain and France in the development and distribution of oil supplies in order to eliminate competition. The agreement is to be applied to all countries where the oil interests of the two nations may conflict and can be usefully united. Both governments are to act jointly to assist their nationals to obtain oil rights from the Rumanian Government, including enemy oil properties sequestrated by the Rumanian Government.

In most instances British and French interests are to be equally represented in the handling of oil properties. Mesopotamia, where British interests predominate, is to have 25 per cent of the properties developed by the British Government or by any Franco-British companies.

The agreement applies to the French colonies and British Crown colonies.

The United States Government is particularly interested in ascertaining whether the agreement is intended to give Great Britain and France superior rights in enemy territories for which the British and French governments have taken mandates. The United States holds that a government having a mandate for enemy territory has no commercial rights superior to those of other countries allied or associated with it in the World War. There has been some correspondence between the United States and Allied governments regarding the protection of American commercial interests in countries governed or to be governed by mandates authorized by the Versailles Treaty and the response received have satisfied officials of the State Department that no attempt is to be made to curtail American rights.

COUNCIL MEETING AT SAN SEBASTIAN.—The Council of the League of Nations met at San Sebastian, Spain, on July 30 and ended its sessions on August 5.

It was decided that the International Financial Conference under the auspices of the League would be held at Brussels September 24, Gustav Ador, former President of Switzerland, presiding. Unless a decision has been reached in the meantime regarding German reparations, that question will not be put in the order of business of the conference.

A permanent naval and military advisory committee was appointed to study and report upon questions of a military character upon which the League may be called upon to act. The commission is described, not as a "League general staff," but simply as a consultative body the principal mission of which will be to advise the league regarding restrictions upon the manufacture of arms and munitions.

TURKEY AND THE NEAR EAST

FRENCH IN SYRIA OVERTHROW FEISAL.—In mid-July, General Gouraud, commander of French troops in Syria, dispatched an ultimatum to Prince Feisal, the so-called King of Syria, demanding that he accept at once the French mandate, recognizing French as the official language, French money as the official currency, and French control over the railway from the seacoast to Aleppo. Though this ultimatum was accepted, the French forces

advanced to occupy the Damascus-Aleppo railway line for transport of supplies. On July 28 it was announced that the French authorities had severed all connection with Feisal and set up a new ministry under French control.

GREEKS ESTABLISH CONTROL IN THRACE.—A brief campaign of Greek forces against Turkish nationalists in Thrace ended on July 25 with the capture of Adrianople. Both in Thrace and in Asia Minor the Greek troops suffered slight losses,—in Thrace about 100 and in Anatolia a few thousand casualties.

DISPUTE OVER AEGEAN ISLANDS.—Paris, July 30.—A possible alteration in the Turkish peace treaty was discussed among the allied representatives to-day, owing to the controversy between Italy and Greece over the Dodecanese Archipelago in the Aegean.

This dispute has reached a point where the government of each country is refusing to sign the Turkish treaty unless the other will cede its claims to the islands. Both Premier Lloyd George and Premier Millerand are advising Italy to sign as an open convention the secret agreement, reached between Italy and Greece on July 29, 1919, under which the islands, with the exception of the Island of Rhodes, would go immediately into the possession of Greece. Premier Giolitti and Count Sforza, the Italian Foreign Minister, have up to the present time declined to be responsible for the agreement entered into by the then Foreign Minister, Tomasso Tittoni, last year, and recognized by subsequent Cabinets.—*N. Y. Times*, July 31.

TURKS SUBMIT TO TREATY TERMS.—On July 17 the Allied Powers answered Turkey's objections to the treaty terms by a statement that unless the Turkish Government ratified the treaty in 10 days, and furthermore asserted its power to enforce the treaty in areas under Turkish rule, the Allies would be compelled to consider the complete ejection of Turkey from Europe. No noteworthy modifications were made in the treaty terms.

The Turkish Government on July 21 decided to accept the conditions imposed and before the end of the month sent a new group of envoys to Paris to sign the treaty.

FAR EAST

AUSTRALIA AGAINST JAPANESE IMMIGRATION.—Paris, July 11.—Japan has found a new outlet for her population in Queensland and Australia and the opposition of the Australians to Japanese intrusion has increased to a dangerous point.

A recent law was passed by both houses of the Australian Parliament imposing a tax of $500 a head on Asiatic immigrants. It was sent to the Governor General for his signature, but under instructions from the British foreign office he refused to indorse the law.

The Australians do not want the Japanese for the same reasons that California does not want them. The only way out for the British Government is to form a new alliance which will take the place of the Japanese document in protecting England's Asiatic interests, and they believe America's future in the Far East will force her to follow the same course."—*N. Y. Times*, July 12.

INQUIRY AS TO JAPANESE POLICY IN SAGHALIN.—Despatches of July 28 announced the receipt by the Japanese Government of a note from the

United States making inquiries as to the purpose of Japan in occupying the northern half of Sahaglin and the adjacent main land. Though no information was issued by the American Department of State, it is understood that the note reiterated the opposition of the United States to the permanent occupation of any Russian territory by Russia's former allies, or to any action in the Far East that would involve a violation of the "open door" policy.

Early in July Premier Hara was questioned in the Japanese Parliament regarding the policy of his government in Siberia.

Premier Hara, replying, said it would be detrimental to Japan's interests to disclose what the government proposed to do if no satisfactory settlement of the Nikolaievsk massacre was found.

"Hattori fears occupation of Russian territory by Japan might leave indelible resentment on the part of the Russians," declared the Premier. "I share his fear, but think it impossible that Japan will do nothing to obtain satisfaction for a massacre in which 700 Japanese lost their lives, even though action is taken that may be productive of Russian resentment.

"As there is no stable government in Russia at present, there is no alternative but to occupy the necessary points in Saghalin province pending establishment of a legitimate government. The diplomatic world and history provide ample precedent for an injured country to take the steps it thinks proper. I am desirous that such a government as will give Japan satisfaction shall be established in Russia as quickly as possible."

JAPAN AND FAR EASTERN REPUBLIC REACH TERMS.—Honolulu, July 22.—Negotiations have been completed between Japan and Asiatic Russia regarding the creation of a buffer State in Siberia, a government memorandum issued in Tokio to-day announced, according to Tokio cables to Nippu Jiji.

Asiatic Russia has agreed to preserve peace to maintain friendly relations with Japan and abolish communism, while Japan has agreed to withdraw her troops from the buffer territory, and the European Bolshevist armies are to be barred from the territory, the memorandum was quoted.

LATIN AMERICA

BOLIVIA AND THE TACNA-ARICA DISPUTE.—The recent revolution in Bolivia which ousted President Guerra and put Savedra in power as provisional president has threatened a shift of altitude on the part of Bolivia in the long standing boundary controversy between Chili and Peru.

Bolivia lost her sea coast in war with Chili in 1873. After the war of 1879-83 between Chili and Peru, Chili also secured the coast provinces of Tacna and Arica, with provision for a plebiscite after 10 years to determine their ultimate disposition. Detailed arrangements for this plebiscite were not fixed at the time of the treaty, and the plebiscite has never been held. Chili, now confident that a vote would result in her favor, has insisted on the execution of the treaty and refused the proposals for international arbitration made by Peru.

Bolivia has hitherto sought the concession of a port and sea frontier by means of an understanding with Chili. It is now possible that she may favor concerted action with Peru. The dispute, which has caused increasing friction since 1915, is not simplified by the turn in Bolivian politics.

VILLA SUBMITS TO NEW MEXICAN GOVERNMENT.—Mexico City, July 28.—General Garcia, chief of staff of the War Office, announced to-day that the final terms of Villa's surrender had been decided upon.

The bandit chief will retire to private life in a place to be designated by the government. He will go first to Torreon to disband his forces, as he will retain no military connection whatsoever.

It is not likely that Villa will come to Mexico City, but will proceed from Torreon wheresoever the government directs.

The negotiations for the surrender have been conducted to the entire satisfaction of the government, Villa obeying all orders.

VILLA SURRENDERS TO NEW MEXICO GOVERNMENT.—Mexico City, July 8.—General Garcia, chief of staff of the War Office, announced to-day that the final terms of Villa's surrender had been decided upon.

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REVIEW OF BOOKS
ON
SUBJECTS OF INTERNATIONAL AFFAIRS

"Handbook for Naval Officers." (D. Van Nostrand Company, New York.)

The value of this compilation of questions and answers is evidenced by the popularity of the mimeographed notes which preceded it and which have passed from hand to hand among officers of the service when preparing for examinations for promotion. The book does not pretend to teach principles—and for complete knowledge of any one of the subjects treated, the student must necessarily seek treatises on the various specialties. It is a digest of information and as such, is of value to the initiated for brushing up and to the unitiated, may serve as a guide to study and practice.

S. E. H.

"The Navy Everywhere." By Conrad Cato. 297 pages. (Published by E. P. Dutton & Co., New York.)

This book contains a collection of interesting accounts of the activities of the British Navy in those theatres of the World War which were sufficiently remote to have escaped almost entirely the notice of the war correspondent of the press. The accounts are based upon official reports, from descriptive details by various officers who took part in the operations, and from the author's own experiences in some of them.

The book is divided into eight sections as follows:

(a) The Navy in East Africa.—The capture of Dar-es-Salaam, bottling up and destruction of the *Königsberg*, and an airman's adventures in connection with same.

(b) The Navy in the Cameroons.—Naval and military operations in the conquest of the Cameroons with interesting incidents in connection with same.

(c) The Navy in Serbia.—Account of the career of the British gunboat *Terror of the Danube*, and of the four British naval batteries co-operating with the Serbs during the disastrous invasion of Serbia by the Austro-German forces.

(d) The first kite-balloon ship.—Account of the H. M. S. *Manica* at Gallipoli and in East Africa.

(e) The Navy in the Persian Gulf.—British ships frustrate German land plans of native raids on coast towns.

(f) The Navy in Roumania.—The operations of British tanks, manned by the Royal Naval Air Service, in the battles of Topalul and Vizirul and in the retreat of the Allied armies from the Dobrudsha.

(g) The Aden Patrol.—Navy guarding Somaliland and the capture of a German raider.

(h) The Red Sea Patrol.—Capture of Salif.

Maps of the various theatres of operating are included. In addition, there are brief summaries of the political history of British activities in Persia and Somaliland which are generally not known.—The book is well written and the subject matter very interesting. Inasmuch as it covers operations of the Great War which are generally unknown this book will be found both instructive and entertaining.

O. O. H.